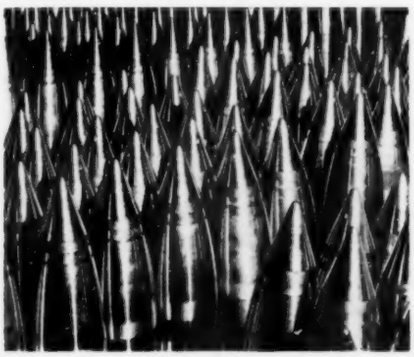
AMERICAN MACHINIST

September 4, 1940



Acme photo

Insurance—*Plenty of shell and guns to fire them may prove the best peace insurance*

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MAJOR ARTICLES

Fixtures Step Up Output.....*Walter Milka* 653
Dial Indicators for Shop Use.....*C. C. Street* 656
Grinding Carbide Cutters.....*Fred W. Lucht* 658
Shop Shots 662
How to Machine 75-mm. Shell..... 667

IDEAS FROM PRACTICAL MEN

Finger Feed for Blanking Dies.....*Henry W. Falstrom* 664
Split Arbor for Trimming Flanges.....*E. O. Schray* 664
Prevents Vellum From Tearing.....*Donald A. Baker* 665
Air Motor to Raise a Shaper Table.....*Edward N. Olson* 665
Spider Improves Layout Table..... 665
Screwdrivers for Close Quarters.....*C. F. Fitz* 665
Ingenuity Plus Welding Saves Money.....*Arthur Havens* 666
Greasing Axle-Lathe Centers..... 666

SHORT ARTICLES

New Fangled Furnaces..... 655
Fighting Aircraft Corrosion..... 661

NEWS OF THE INDUSTRY

Gaging Business..... 682b
Watching Washington. 682g
Inside Detroit 682i
Names in the News... 682k
Plant Expansion..... 682k
Obituaries 682l

DEPARTMENTS

What's in This Issue.. 37
Reference Book Sheet.. 679
Editorial 682a
Shop Equipment News. 683
Trade Publications..... 693
New Books..... 694

ADVERTISING PAGES REMOVED

American Machinist

Announces Its

ANNUAL METAL SHOW NUMBER

October 16, 1940, featuring

1. **SHOW-IN-PRINT:** Descriptions of new equipment to be displayed for the first time at the Metal Show in Cleveland, October 21-24.

2. **WORKING OF COLD-ROLLED, SHEET CARBON STEEL:** Ninth in American Machinist's series of special sections on the Working of Materials—including detailed data on punching, drilling, forming, welding, annealing, preparation for finishing, etc.

3. **APPLICATIONS OF HEAT-TREATING IN MUNITIONS MANUFACTURE.** What's new in heating and heat-treating—practical hints applicable to many jobs.

4. **APPLICATIONS OF WELDING IN MUNITIONS MANUFACTURE.** A special picture-caption story of latest adaptations.

WHAT'S IN THIS ISSUE

OLD GRINDS

. . . are not so good for new type cutters, especially those tipped with carbide. Half the secret of the phenomenal performance of carbide tools lies in precise control of the cutting edge angles. In his second article on grinding carbide cutters, Fred W. Lucht, of Carboloy, tells how to save both time and money by eliminating cut-and-try methods. His advice is on page 658.

FOR DEFENSE

America's defense needs can be summed up in three words: men, machines, munitions. Methods of converting an adequate amount of the country's vast manpower into an effective military force are daily being debated in legislative chambers, in offices, in almost every home throughout the land. The greatly more complicated problem of machines—both machines of war and machines to make those machines—is being thrashed out by military experts and industrial authorities. And munitions manufacture is not only being rushed, but the technique is being streamlined as well. Shops the country over are urged to familiarize themselves with problems of materiel production. To this aim the section beginning on page 667 is dedicated.

This section is known as the Armament Section of AMERICAN MACHINIST. Scheduled to appear in virtually every issue until the present defense crisis is past, this section will give tangible, specific details as to how *you* can manufacture various items of military importance. The first section, for instance, tells *how to make* 75-mm. shells—not just how an arsenal makes them. It is no condensed outline, either, but contains twelve pages jammed with recommendations and details of the tooling involved. Though the methods described were worked out at Frankford Arsenal, they can be applied by anyone making this type of shell.

INGENIOUS

"Production of training plane engines is quadrupled by the use of ingenious tooling set-ups." We quote from page 653. Doubling, tripling, quadrupling aircraft engine production is no news these days. But when it's done without appreciable expansion of plant facilities, that *is* news. If a plane engine maker can do it, so

WALTER MILKA

. . . production manager of Kinner Motors, reveals how aircraft engine production was quadrupled with little more than ingenious tooling set-ups

can anyone else. Anyone else, that is, who's swinging from small-lot operation to considerably greater production. Making the changeover involves a few headaches, but nothing that intelligent planning (and maybe a little Alka-Seltzer) won't cure. Walter Milka, production manager of Kinner Motors, the company under discussion, is in a position to offer considerable concrete advice on the subject. In "Fixtures Step Up Output" he does just that.

GOOD INDICATION

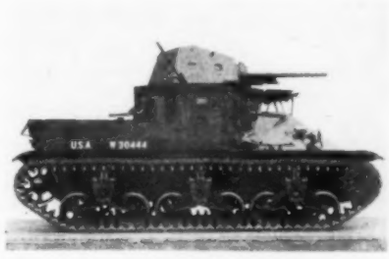
If by now you haven't become engrossed in C. C. Street's series on measurement for production, it's high time you were digging out those back issues and catching up. For AMERICAN MACHINIST publishes no synopses of preceding chapters. This issue's installment, which begins on page 656, to our mind is packed with some of the most useful information so far. It discusses the construction and operation of dial indicators—including an analysis of theoretical errors and practical compensations. Which is all to the good when it comes to getting maximum accuracy out of those useful little indicators which are daily becoming still more useful.

PHOTOPHILE

Which, in accordance with Webster, might mean a lover of photographs. Or, if you're in your best punning form, a collection of photographs. In either case, you may possibly be thankful that that was the title we rejected in favor of Shop Shots, a department relatively new to these pages. Like Short Cuts for the Small Shop, which have become so popular, Shop Shots will appear "every now and then" to round out our editorial content, will depict various time-, money- and temper-saving devices worked out in all kinds of plants, large and small. On page 662 we present the second batch.

COMING

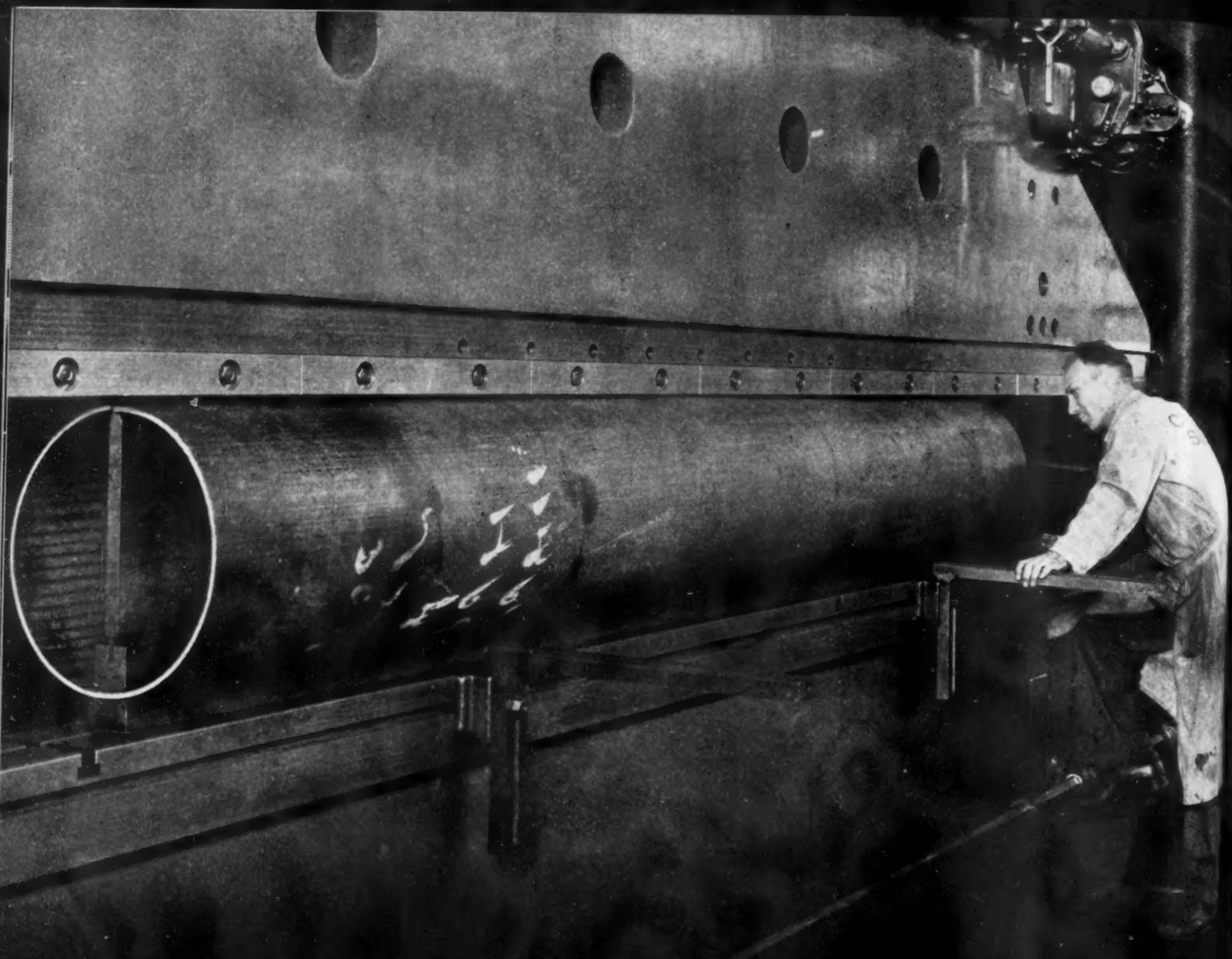
Tanks by the ton have played an important part in World War II. What is the United States doing in the way of tank development? Well, Rock Island Arsenal, for instance, at present is producing combat cars and medium tanks which, after minor bugs have been ironed out, will probably be built in private plants also. What are these tanks like? How are they made? What are some of the



M 2

. . . is the Army's official designation for this medium tank, which is now being produced at the Rock Island Arsenal. How it's made will be detailed in the next Armament Section of American Machinist, scheduled for September 18

production problems? These and other vital questions will soon be answered in a forthcoming article on tank manufacture. Look for it in an early issue of AMERICAN MACHINIST.

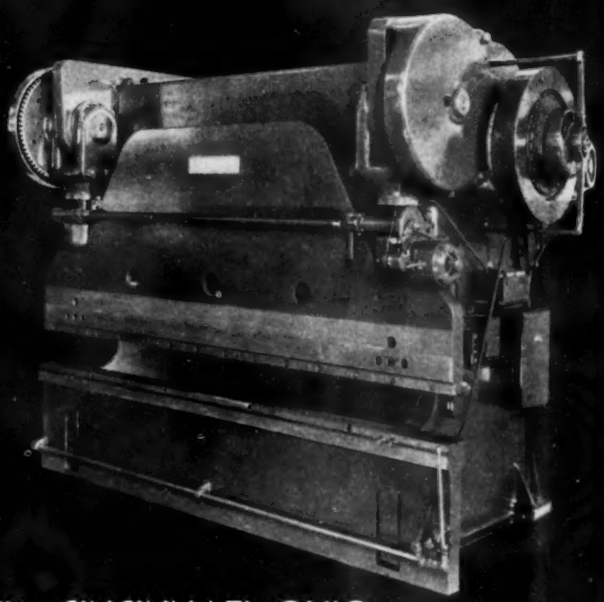


Pipes . . . Tubes . . . Posts

. . . are easily and accurately formed on Cincinnati Press Brakes.

Cincinnati Press Brakes are also used for crimping sheet and plate before rolling to eliminate flats at seam edges of rolled shapes.

Write for recommendations on your job.



THE CINCINNATI SHAPER COMPANY, CINCINNATI, OHIO

SHAPERS • SHEARS • BRAKES

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

Fixtures step up output

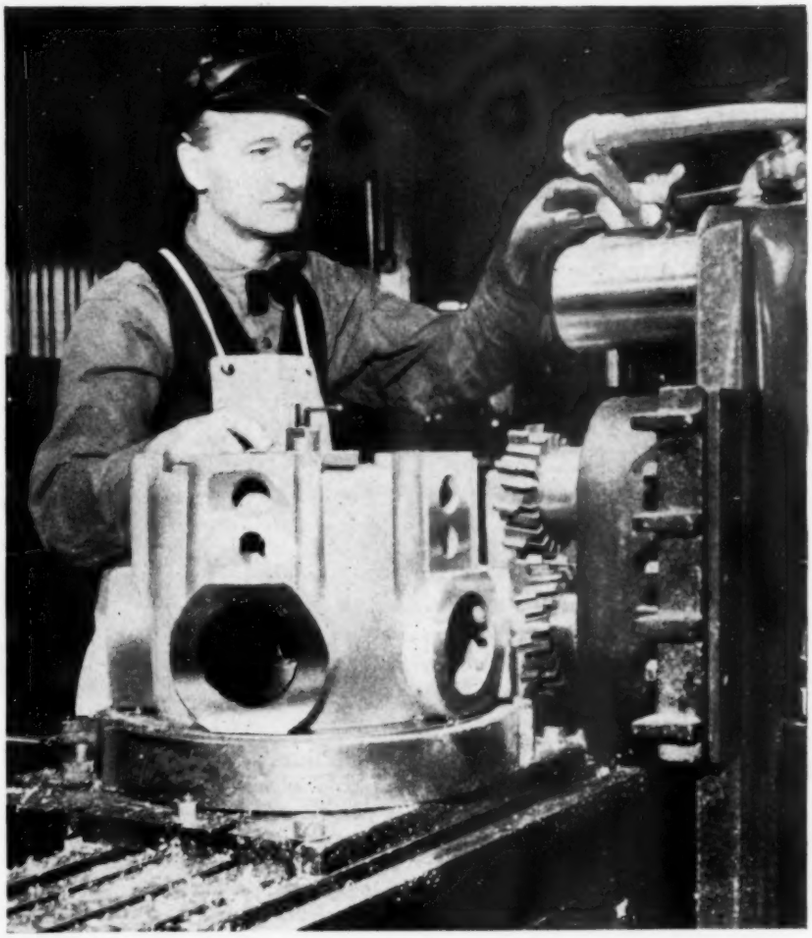
BY WALTER MILKA, PRODUCTION MANAGER, KINNER MOTORS, INCORPORATED

Production of training plane engines is quadrupled by the use of some ingenious tooling

IN THE MIDST of an expanding domestic business, Kinner Motors, Incorporated, was suddenly favored with a substantial order for engines to be used by Canada in the Empire pilot training plan. Practically overnight the company had to boost production from less than one engine a day to more than 100 a month, and it is now striving for 250.

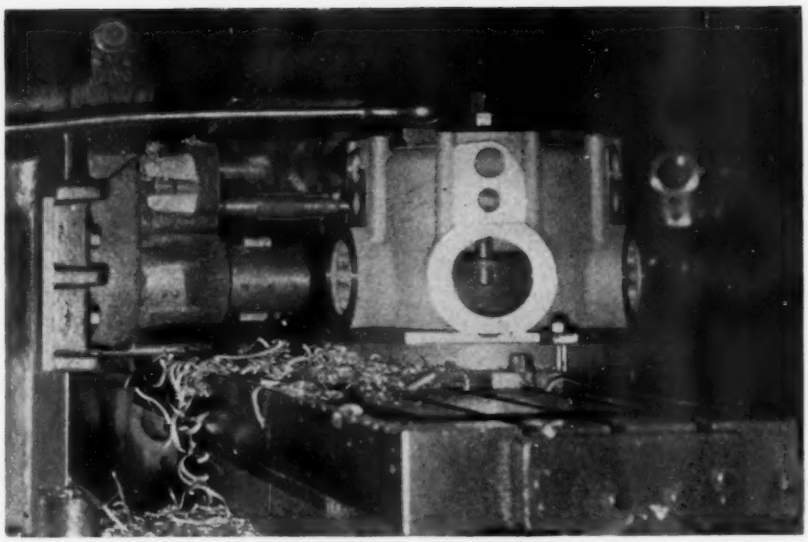
This increase has not been accomplished by a vast expansion of plant facilities, but rather by the design of clever fixtures which salvage much time ordinarily lost in set-ups and change-overs. There was not opportunity to obtain and place in operation new machinery, nor was there time to alter the engine design to adapt it to higher production. Equipment in the plant included a limited number of production-type machines such as Bullards and Warner & Swaseys. The rest consisted largely of standard lathes, milling machines, grinders and drill presses. Thus operations had to be based on versatility of both men and machines.

Fortunately Kinner Motors, a new company, had taken over the assets of a firm which had designed an engine for relatively substantial production. Thousands of Kinner engines had already been produced. The company had also obtained the services of most of the men who had been with the original Kinner organiza-

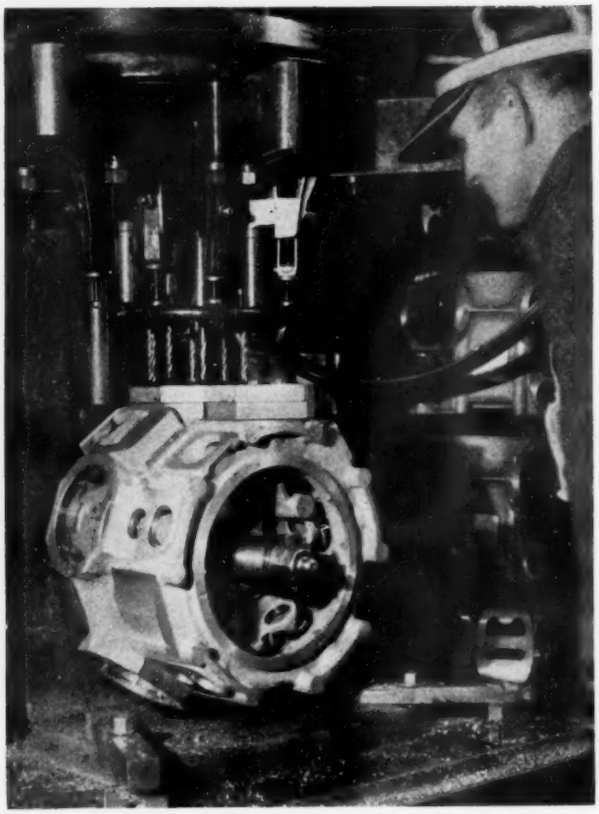


Pads for cylinder bases, tappet guides and intake pipes for the five-cylinder Kinner radial engine are milled in a single operation with a special duplex milling head on a Milwaukee horizontal mill. Sixth indexing point on fixture permits milling the oil sump pad, located between the two bottom cylinders. Part being machined is the crankcase, a one-piece aluminum alloy casting

A horizontal mill equipped with a special triple head permits simultaneous boring of cylinder base hole, tappet guide hole and intake port. Holes are chamfered in the same operation. A five-point indexing fixture is used



Use of a two-point fixture with this duplicate set-up of master connecting rods permits milling the H section on both sides of each rod at one set-up

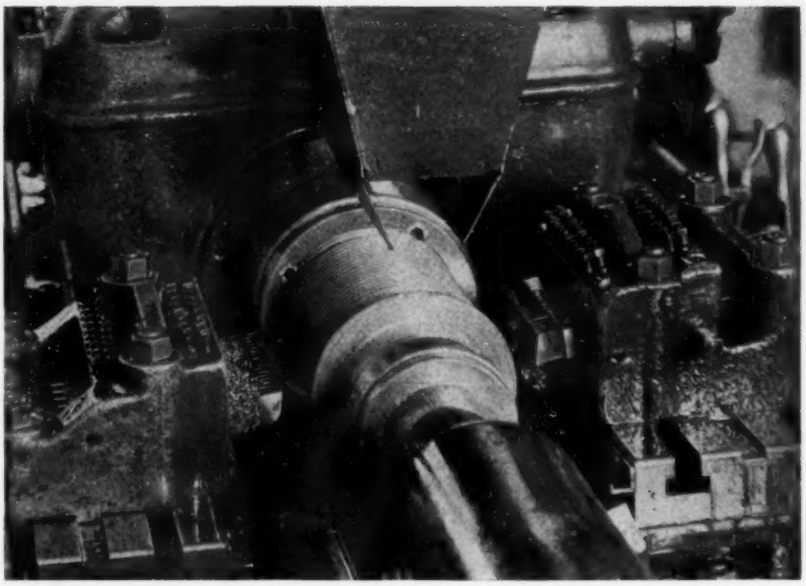


This Natco Multi Drill is set up for drilling eight cylinder hold-down stud holes in each of the five cylinder base pads of the Kinner crankcase. Drill jig includes a five-point indexing fixture

tion during the growth of private flying. The most important single factor in boosting output was the rapid development of a large number of special machine fixtures. Partially as a result of installing such production aids, the shop was able to operate a second shift with a minimum of lost motion. These fixtures were developed with three factors in mind: precision, cost and production. They had to be rugged, simple, accurate and not too expensive. The higher the production the more rigidly must tolerances be observed, for the plant could not afford to tie up the assembly line with misfits.

Fixtures as developed achieved three major objectives. In a number of cases indexing jigs could be used which simplified shifting the work for a sequence of identical operations on a given piece. Such a fixture is used for milling the five cylinder base pads on the main crankcase. Other fixtures make it possible to perform duplicate operations in tandem, as in the case of certain milling operations on connecting rods. In other cases, duplicate operations are performed through using indexing jigs to reverse the piece, as in channel milling the H-section on connecting-rod shanks. Various combinations of these ideas are used and full advantage is taken of many machining short cuts, such as milling two faces at once with a single set-up, or doing three simultaneous boring operations with a triple-head mounted on a horizontal mill.

First operation on the crankcase



With this set of multiple cutting tools, seventeen fins are turned simultaneously from the solid. Rough cut is taken by the rear tools, right, chips falling directly into scrap pan. Front tools take finishing cut

is to turn a locating face at the front section where the front cover mounts. This is done in a clamp fixture. Thereafter locating fixtures are used and the case is reversed on the Bullard for boring and facing operations for mounting the rear cover, and boring the main bearing mount and oil groove. The case then moves to a Milwaukee horizontal mill where it is mounted in a six-position radial fixture and milled with a double tool head. This permits simultaneous milling of the cylinder base pads and the pads for the valve tappet guide and intake pipe fittings. The oil sump pad, located radially in the same plane as the cylinder base pads, is the sixth operation in this fixture. A Milwaukee horizontal mill equipped with a triple boring head is used to bore the cylinder base, intake pipe, and valve tappet guide holes simultaneously. The tool set-up provides for chamfering the cylinder base and intake pipe holes in the same operation by driving the tool arm in until the chamfering tools are engaged. A five-point indexing fixture is used for this operation. Another indexing fixture and drill jig is used for simultaneously drilling the eight cylinder hold-down stud holes in the cylinder base pads on the crankcase, this work being performed on a Natco Multi Drill.

Cylinder heads are held in a Warner & Swasey turret lathe by a special chuck for six successive operations, which include facing the head flange for attachment to the barrel, turning the inside diameter and machining the combustion chamber. Valve gear rocker arms are also machined on Warner & Swaseys. Master connecting rods are machined in pairs for a number of operations. They are mounted in pairs for four shank facing operations on a Cincinnati horizontal mill, an indexing fixture being used. Milling the H section channels in the master rod shanks is also done in pairs on a Cincinnati horizontal mill with indexing fixtures. For drilling, rods are paired and mounted in a Moline Hole Hog where three drills simultaneously drill the two piston pin holes and the single hole where the two big ends butt together. Bearing caps are later assembled to their rods for a finish cut.

Many operations require pot or straddle fixtures of ingenious design to circumvent the awkward shapes, from a machine standpoint, of such parts as the rear crankcase cover. This cover has two magneto pads at the rear cast integral with it and extending out for a distance approximately equal to the diameter of the cover itself.

Kinner has more than quadrupled production in six months. With the addition of newer equipment, including automatic machinery for some operations, and with the assurance of larger orders to permit still more elaborate tooling, it will be able to expand its production still more. Much credit for achieving such expansion should be given to the ingenuity and originality of the shop men, who are constantly developing new kinks for fixtures which will allow machines to reach their true capacity.

THE KINNER ENGINE

. . . is of conventional air-cooled radial design having five cylinders. Three series, of 100, 125 and 160 hp., are in production, with many parts interchangeable between these models. Present production efforts are now concentrated on the 125-hp. model.

Largest engine part is the crankcase, a single-piece aluminum alloy casting with a front and rear cover. The single-throw crankshaft is also of one-piece construction, except for balance weights bolted to it. There are four single-piece articulating rods and a two-piece master connecting rod. Cylinders are steel forgings, machined down to about 7 lb. from a 65-lb. ring. Cylinder heads are of cast aluminum alloy bolted direct to the cylinders. Each cylinder assembly is held to the crankcase by short studs at the cylinder flange. Overhead valves are operated by five camshafts in the accessory case at the rear of the engine.

New Fangled Furnaces

NEW FANGLED notions, such as frying eggs over a newspaper that doesn't even get warm, make spectacular exhibitions for laboratory demonstrations. But when the idea works its way into production processes even the most "practical" man has to look into it, or else be left behind the bandwagon of progress.

This very "stunt" is now being used in heat-treating departments of some large plants in place of the usual gas or electric furnace. The work is just placed inside of an induction coil and is brought up to quenching temperature without any appearance of heat except in the piece itself. This and other developments make the electrician as much a part of plant operation as the all-round mechanic who keeps the automatics and other machines turning out their stuff.

Dial indicators for shop use

BY C. C. STREET, CHIEF ENGINEER, FEDERAL PRODUCTS CORPORATION

Dial indicators frequently are used on jigs and fixtures, as well as on inspection units. Care in mounting is essential to prevent frictional errors

THE MECHANISM of dial indicators consists of many moving parts interrelated with each other. At the connection of each of these moving parts there almost invariably is a sliding surface. By the time all of these frictional forces are added together they offer an appreciable amount of resistance to the motion of the instrument. This means that friction tries to keep the instrument from starting and tries to prevent its return, so that regardless of the action of springs in the indicator, there always is a certain amount of lag in the action of the instrument. The lower the spring tension with which the instrument can be made to work, the less will be the friction.

A little known fact concerning dial indicators is that they possess measurable amount of friction. This friction is measured by mounting the instrument in a fixture and measuring the amount of force necessary to start the measuring point into motion. After some assigned amount of motion has taken place, usually about 0.003 in., the instrument is allowed to return and the amount of force it exerts in doing so is measured. At this point in the range, the difference between these two values represents the amount of friction that exists in the instrument.

Instruments can be made so that this frictional difference is reduced to an extremely small value, but they are invariably instruments of low magnification (about 0.100 in. motion of the contact point for one revolution of the hand) and of short range. The term range as used here refers to the total possible travel of the contact point. The best of specially constructed instruments will have a frictional difference of force of about five grams.

Given the same care in workmanship as the low magnification instrument, a friction of between 25 and 30 grams will be encountered at a magnification equal to 0.010 in. motion of the contact point for one revolution of the hand and a total range of 0.020 in. Ordinary instruments as generally used for jig and fixture work will have friction in the neighborhood of 60 to 70 grams for the higher magnification types.

Without proper care in the method of mounting the instrument, this friction will produce serious errors in the readings obtained. Suppose an indicator is mounted at the end of a $\frac{5}{16}$ in. rod some 6 in. long, as shown in Fig. 7, and the instrument in question has a frictional rating of 60 grams. If we assume that it takes 100 grams to start the instrument in motion, by calculation we find that a $\frac{5}{16}$ in. rod 6 in. long will deflect at its end 0.00124 in. for a load of 100 grams, as shown by position *A* in Fig. 7. In this set-up the indicator itself will move upward 0.0012 in. before any reading is given. Now if the work is a slightly eccentric cylinder that is being slowly rotated under the contact point, it will gradually move away from the instrument, and the contact point will now exert only 40 grams in returning. The bar will then return toward its original position until it is deflecting an amount equal to a force of 40 grams. This by calculation will be 0.000496 in., so that there will exist an error in the reading of eccentricity equal to the difference between these two deflection values, which will be 0.000744 in. If the actual eccentricity were 0.003 in., the indicator would read 0.0023 in.

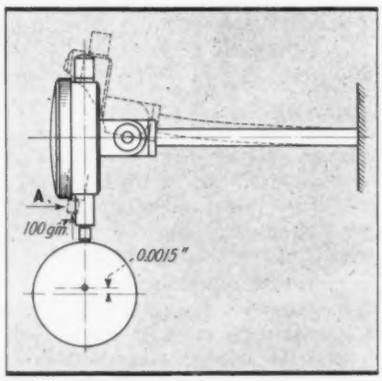


Fig. 7—Unless properly supported, friction in the indicator may cause it to deflect under the pressure of contact for a reading

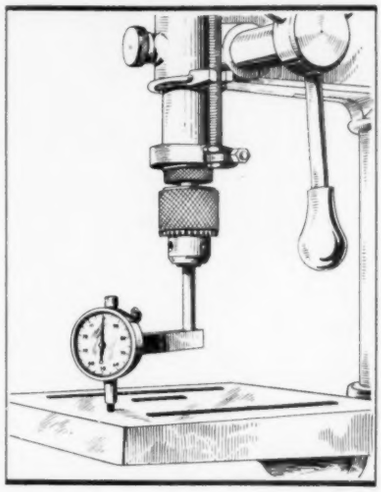


Fig. 8—A simple set-up with a dial indicator makes it easy to determine whether the table of a drill press is square with the spindle

It is obvious from this explanation that a more rigid method of mounting the instrument would reduce the error appreciably, and by the use of a proper fixture it could be made unimportant. One very simple way

of determining the reliability of any indicating set-up is to place the part to be measured under the contact point and then with the finger pressed against the case of the instrument slightly depress it downward. The pressure of the finger is now gradually released so that the instrument returns to its original setting. This return must be allowed to take place very slowly, so that inertia of the moving parts will not carry it beyond the point at which it otherwise would stop. The value of this reading is noted, and the instrument is then pressed upwards in the same manner and slowly released. It will be found in most instances that the two final readings are not alike, and may differ by as much as 0.003 or 0.004 in. This difference represents the error that can be caused by friction in the instrument when the readings are taken.

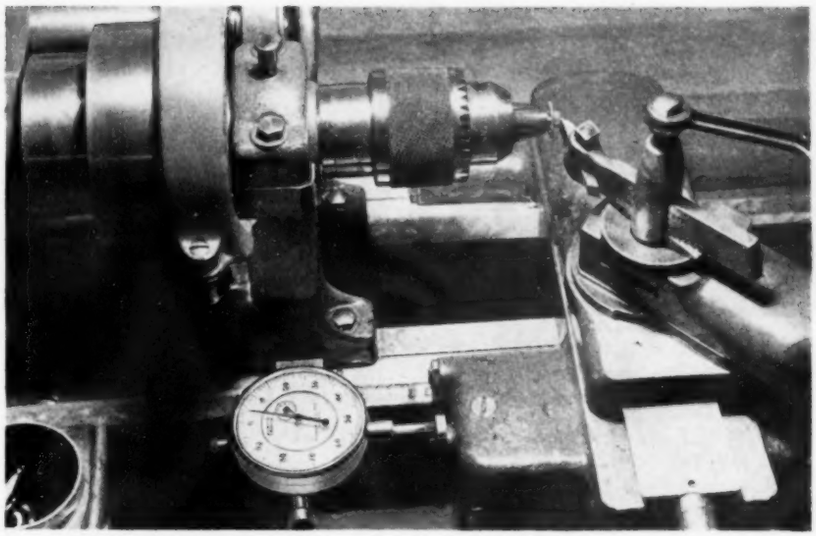


Fig. 9—By clamping an indicator on a lathe, it is a simple matter to reposition the carriage accurately

Errors From Pressure Variations

When indicators are used on light and delicate parts, the actual force exerted by the contact point is of importance since this force can produce a change in the part being measured, just as the friction in the instrument can produce a change in the mounting fixture. In nearly all instances contact pressure can be kept at its lowest value when the range is short. This is due to the fact that there is only a limited amount of space in the case of the instrument and if, for example, $\frac{1}{2}$ in. is needed for travel and the instrument has a diameter of $1\frac{1}{2}$ or 2 in., there will only be left approximately $\frac{1}{2}$ to $\frac{3}{4}$ in. space for the spring. This means that a spring must be designed capable of extending $\frac{1}{2}$ in., yet being only slightly more than $\frac{1}{2}$ in. in free length, since it must exert a certain amount of pressure when the instrument is in its fullest extended position. An examination of spring tables will show that such a spring will invariably have a high spring rate (increase in force for a given amount of extension) and this means that the force exerted by the contact point will increase rapidly under such an arrangement. When a short range instrument is used, it is possible to actuate the mechanism with a long soft return spring, and in this manner there is, of course, less change in contact pressure over the working range. Instruments having a working range of $\frac{1}{2}$ in. will often have a starting force of around 100 grams, which will increase at the end of their travel to some 200 or 300 grams, which represents almost $\frac{3}{4}$ lb.

It is well to note that this change in contact force can also produce an error in reading just as that produced by friction, since the instrument will start at 100 grams of force which will produce a deflection in a $\frac{5}{16}$ in. rod 6 in. long of 0.00124 in., but by the time the entire range has been used the pressure exerted by the contact point will be 300 grams and the deflection of our $\frac{5}{16}$ in. rod will be 0.00372 in. We, therefore, have an error in readings equal to the difference between these two values, which will be 0.00248 in.

Squaring a Drill Press Table

By applying simple principles of geometry, many measurements can be made with dial indicators that are independent of any outside standard. An example of this might be where one desired to ascertain if the table of a drill press is square with the spindle. One method used by many mechanics is to place in the chuck a piece of drill rod, and then place a toolmaker's square on the table and see if the blade is parallel with the drill rod. The accuracy of this test depends, in the first place, on whether or not the jaws of the chuck are in true alignment with the axis of rotation of the drill spindle, and secondly, if the piece of drill rod is truly straight. A third item that must be accurate for this test is the square itself.

It can be seen easily that with so many factors controlling the reliability of the results, there is apt to be some doubt as to the value of the readings obtained. This problem can be simply solved by using a dial indicator set up as shown in Fig. 8. The bar may be made of any piece of cold rolled steel by simply drilling two holes at right angles in the opposite ends of the piece, one to receive the indicator and the second tapped to receive a rod held in the drill chuck. The spindle is lowered until the indicator touches the table, then it is locked in place and slowly revolved. The squareness of the table is determined by observing the amount of movement of the indicator hand, and can be read easily to 0.001 in. at a radius of 6 or 7 in. from the drill spindle. This represents a check so accurate that if the table were out of square by an angle of 30 sec. it could be determined by this method. Checking with this method gives the true out-of-squareness between the table and the axis of rotation of the spindle and will not include any chance misalignment of the chuck jaws.

A convenient application of indicators consists of measuring the longitudinal travel of a lathe carriage, as in Fig. 9. A simple clamp can be designed so that it will hold an instrument on one of the outer dovetails of the lathe bed, so that the contact point can touch a smooth surface on the carriage. Very accurate parts have been made by this method. Some parts recently made were staffs, similar to those used in watches, where the diameters were in the neighborhood of 0.030 or 0.040 in., and the shoulders in the steps of some 0.025 to 0.030 in. These experimental parts later were checked with a microscope and found to be accurate within plus or minus 0.0005 in.

The fourth article in this series by Mr. Street will appear in an early number.

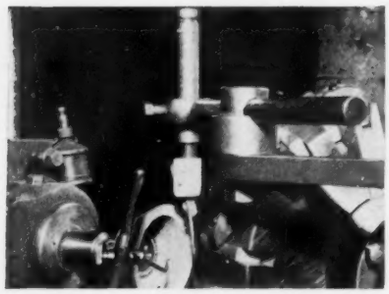


Fig. 5—The first operation is the cylindrical grinding of the periphery of the cutter

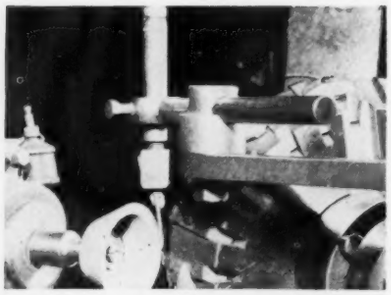
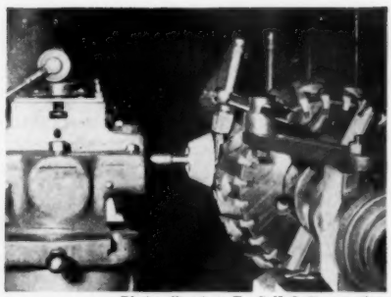


Fig. 6—The second operation consists of grinding face of cutter with a silicon-carbide wheel



Photos Courtesy Ex-Cell-O Corporation

Fig. 7—The third operation consists of cylindrical grinding chamfer on the cutter blades

Grinding carbide cutters

BY FRED W. LUCHT, ENGINEER, CARBOLOY COMPANY

II—Accurately ground milling cutters are produced easily by following this suggested series of operations. Cut-and-try is eliminated and costs are cut

WHEN A MILLING CUTTER is returned to the toolroom for sharpening, the cutting edges should be examined carefully for signs of abuse, and to determine the type of dullness. As a result of this inspection, an experienced supervisor can determine whether better performance might be obtained by increasing or decreasing the rake and clearance angles.

Before resharpening, the chip clearance between the cutting edges and the cutter body should be checked. If insufficient, this space may sometimes be increased by grinding, in the case of a solid cutter, or by resetting the blades of an inserted-tooth cutter. The cutter should be inspected for distortion and hole wear, and corrected as necessary. Burrs on the edges of holes, counterbores or drive keyways are removed with a hand stone before resharpening the cutter.

Cutter Grinding Routine

When grinding carbide-tipped cutters with either straight or cup wheels, the wheel always should rotate onto the cutting edge, that is, from tip toward shank, as indicated in Fig. 3.

The following general instructions, discussed in the first part of this article (*AM*—Vol. 84, page 603), apply to all of the grinding operations described below for carbide tipped milling cutters: (1) Wheel speed will range from 2,700 to 5,500 ft. per min. (2) When using a cup wheel swing the wheel spindle slightly so heel of wheel will clear work. (3) Wheel in-feed per pass should be 0.002 in. when cylindrical grinding and when grinding rough back-off with silicon-carbide wheels, and 0.0003 to 0.0005 in. when sharpening (applying final finish) with silicon-carbide or diamond wheels. (4) Use steady hand feed of about ¼ in. per second. (5) Keep grinding wheels open and free-cutting. When necessary, use a wheel dresser on silicon-carbide wheels. If a diamond wheel loads, use a cake of pumice stone to clear the wheel face.

The routine for successfully sharpening multi-blade milling cutters divides itself into four general classifications, based upon the condition of the cutting edges before they are sharpened:

1. All tips of an inserted-blade cutter worn down to where they will not cover depth of cut. Cutter needs new set of blades. Use all grinding operations Nos. 1 through 10 as outlined below. This involves complete resharpening of the cutter.

2. If all cutting edges of an inserted-blade cutter are sharp, with the exception that one or more blades are

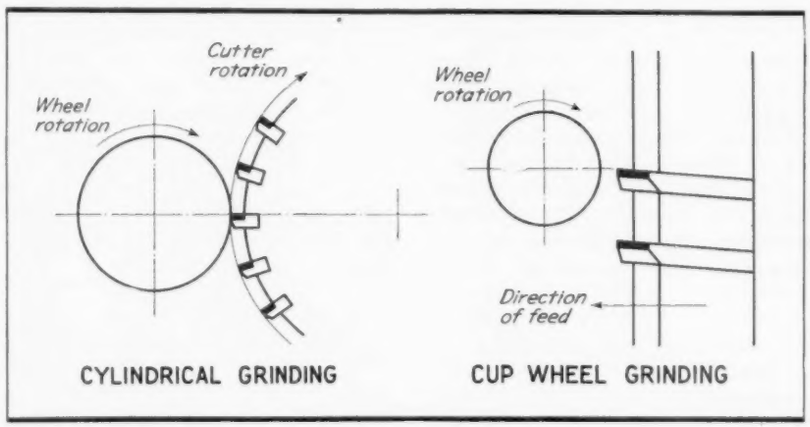


Fig. 3—Best results are obtained by driving the grinding wheel so that it will rotate from the tip toward the shank of the blade

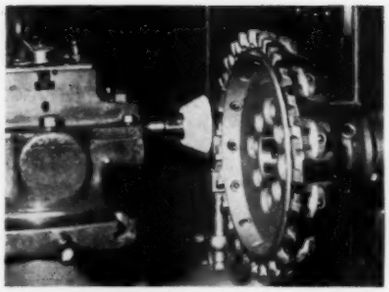


Fig. 8—In grinding tooth back-off on the periphery, tooth rest is lined up with wheel and cutter centers

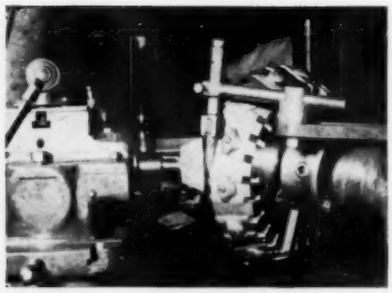
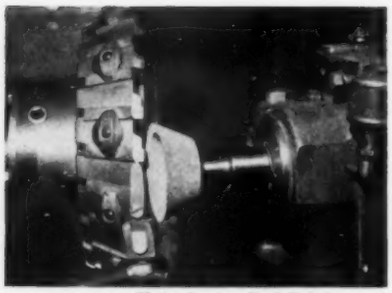


Fig. 9—The tooth rest is set off center an amount shown in Tables I and II to give desired clearance



Photos Courtesy Ex-Cell-O Corporation

Fig. 10—The fourth operation is the grinding of rough back-off on each tooth of the cutter

damaged and must be replaced, use operations 4 through 10.

3. If none of the teeth are damaged and all cutting edges are dull, and the diamond wheel would come in contact with the steel shanks, use operations 4 through 10.

4. If all cutting edges are dull, none of the teeth are damaged in any way, and it is possible to sharpen the cutter without contacting the steel shanks with the diamond wheel, use operations 5, 7, 9 and 10 for reconditioning the cutter.

In all cases where blades must be removed from the cutter body, the damaged blades should be ground separately to a templet before replacement in the body. The templet should be taken from a new, finished blade. If new blades do not conform closely to those in the cutter they should be hand ground to the templet on a pedestal-type grinder, using a silicon-carbide straight wheel. A dial indicator should be used when reassembling blades in a cutter body, so that all blades will be set to a uniform height and grinding time can be held to a minimum.

A modification of the following general procedure for sharpening inserted-blade face mills also is applicable to the grinding of other milling cutters, core drills, finish boring tools, counterbores, spotfacers and hollow mills. Blade shapes generally recommended for face mills are shown in Fig. 4. In sharpening carbide-tipped face mills and other milling cutters the following sequence of operations has been found to give best results:

1. *Circle grind periphery*—Set up cutter on adapter and cylindrical grind both carbide and steel on outside diameter of the cutter with a silicon-carbide straight wheel, as in Fig. 5. When work specifications demand a better-than-average finish, Operation 1 should be followed by Operation 1-A, which is a repetition of Operation 1 using a diamond wheel.

2. *Surface grind side of teeth*—Swing wheel head and surface grind both carbide and steel on face (side teeth) of cutter, as in Fig. 6, with silicon-carbide straight wheel. As in Operation 1, Operation 2 may be followed by Operation 2-A using a diamond wheel when work specifications require a better finish than average.

3. *Circle grind chamfer*—Swing compound table to chamfer angle and cylindrical grind carbide and steel on chamfer of cutter with silicon-carbide straight wheel. See Fig. 7. Operation 3-A is the same as Operation 3, except that a diamond wheel is used; it is employed when a better-than-average finish is required on the work.

4. *Rough back-off periphery*—Remove cutter from the adapter used for Operations 1, 2 and 3, and mount on grinding attachment. Set grinding attachment to grind rough back-off and sharpen periphery. Replace straight grinding wheel with silicon-carbide cup wheel.

Next, line up wheel center and cutter center in either the same horizontal or vertical plane, depending on the machine used. Set up tooth rest and adjust its end in line with wheel and cutter centers, as in Fig. 8. A surface gage with a scriber point will be found helpful. Then adjust tooth rest off center amount determined from Tables I and II sufficient to give desired clearance, as in Fig. 9.

Grind rough back-off on each tooth of cutter up to land width of 0.010 to 0.030 in. as shown in Fig. 2 (*AM*—Vol. 84, page 603). It may be necessary to swing the compound

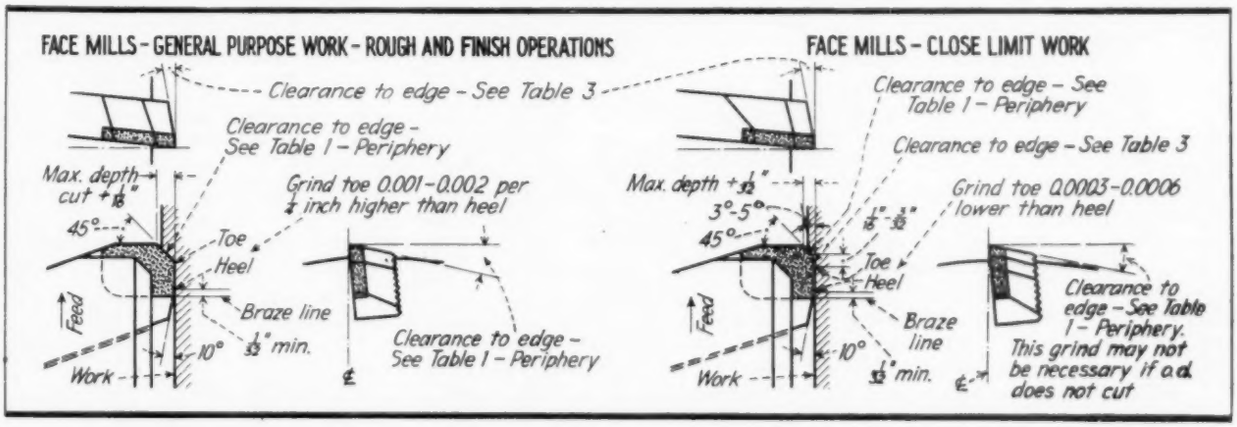

FACE MILLS - GENERAL PURPOSE WORK - ROUGH AND FINISH OPERATIONS
Clearance to edge - See Table 3
Clearance to edge - See Table 1 - Periphery
Max. depth cut + 1/16"
45°
Grind toe 0.001-0.002 per inch higher than heel
Toe
Heel
Feed
Braze line
1/32" min.
10°
Work
Clearance to edge - See Table 1 - Periphery
FACE MILLS - CLOSE LIMIT WORK
Clearance to edge - See Table 1 - Periphery
Clearance to edge - See Table 3
Max. depth + 1/32"
3°-5°
45°
Grind toe 0.0003-0.0006 lower than heel
Toe
Heel
Feed
Braze line
10°
1/32" min.
Work
Clearance to edge - See Table 1 - Periphery. This grind may not be necessary if o.d. does not cut

Fig. 4—Carbide-tipped face mills are ground to suit the requirements of the job at hand. Diamond wheels are recommended for final grinding operations where work specifications demand a better-than-average finish

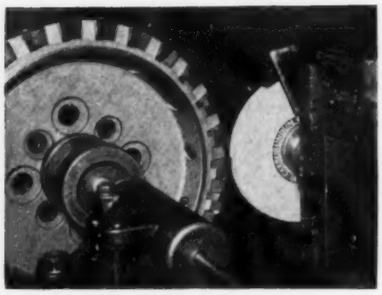


Fig. 11—The sixth operation consists of grinding rough back-off of the side teeth on the face of the milling cutter

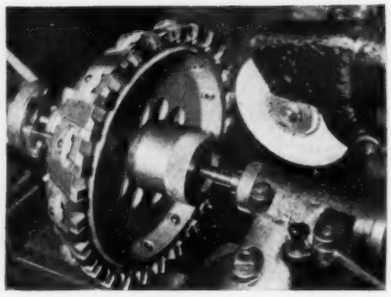
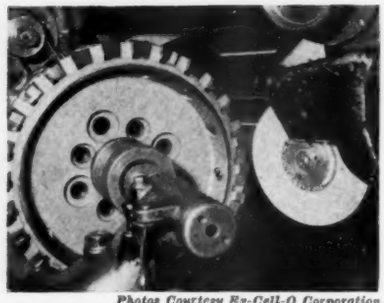


Fig. 12—This set-up is used for grinding rough back-off on the chamfer in Operation 8. Use a silicon-carbide wheel



Photos Courtesy Ex-Cell-O Corporation

Fig. 13—The heel of the blade on face of the cutter is ground in this set-up during Operation 9, using a silicon-carbide wheel

table of the grinder in order to obtain a uniform land width. Set-up for Operation 4 is shown in Fig. 10.

5. *Sharpen periphery* — Adjust tooth rest for cutting clearance on carbide (See Fig. 2 and Tables I and II). Grind clearance to edge of each tooth on outside diameter of cutter. It may be necessary to swing compound table in order to obtain a uniform cutter diameter. Set-up is the same as that shown in Fig. 10, except that a diamond flaring-cup wheel is used.

6. *Rough back-off side teeth*— Swing grinding attachment to position for grinding face (side teeth) of the cutter, as in Fig. 11. Tilt cutter vertically an amount sufficient to give the desired rough back-off angle. This angle is shown directly on the vertical graduated scale of the grinding attachment. Recommended clearance angles for side teeth are given in Table III.

Rotate cutter until the cutting edge of one side tooth is approximately horizontal. Adjust tooth rest to the face of this tooth. Grind each tooth up to a land width of 0.010 to 0.030 in. as shown in Fig. 2. Use a silicon-carbide cup wheel. It may be necessary to swing the compound table to obtain a uniform width of land.

7. *Sharpen side teeth* — Loosen tooth rest and reset grinding attachment for cutting clearance on side teeth by reducing vertical tilt angle. See Fig. 2 and Table III. Rotate cutter until cutting edge of one side tooth is in an approximately horizontal position, then adjust tooth rest to the face of this tooth. Set-up is same as that shown in Fig. 11, except that a diamond flaring cup wheel is used. Grind clearance to edge on each tooth. It may be necessary to swing compound table to obtain needed high or low heel.

8. *Rough back-off chamfer* — Reset grinding attachment to horizontal position. Swing attachment to position for grinding chamfer. Adjust tooth rest for rough back-off on chamfer (See Fig. 2 and Tables I and II). Use a silicon-carbide cup wheel and grind each tooth up to a land width of 0.010 to 0.030 in. It may be necessary to swing compound table. Set-up is shown in Fig. 12.

9. *Sharpen chamfer*—Adjust tooth rest for cutting clearance on carbide (See Fig. 2 and Tables I and II). Grind clearance to edge on each tooth on chamfer of cutter. It may be necessary to swing compound table. Set up is the same as shown in Fig. 12 for Operation 8, except that a diamond flaring cup wheel is used.

Table II—TOOTH REST SETTINGS FOR CLEARANCE ON PERIPHERY OF MILLING CUTTER

Cutter Diameter in inches	*Peripheral Clearances (Expressed in inches indicator drop $\frac{1}{16}$ in. behind cutting edge)*												
	0.005	0.006	0.007	0.008	0.009	0.010	0.011	0.012	0.013	0.014	0.015	0.016	0.017
	Set tooth rest off center in thousandths of an inch as follows:												
½	0.051	0.055	0.059	0.063	0.067	0.070	0.074	0.078	0.082	0.086	0.089	0.093	0.097
¾	0.061	0.067	0.073	0.079	0.085	0.090	0.096	0.102	0.108	0.114	0.119	0.125	0.131
1	0.071	0.079	0.087	0.095	0.103	0.110	0.118	0.126	0.134	0.142	0.149	0.157	0.165
1¼	0.081	0.091	0.101	0.111	0.121	0.130	0.140	0.150	0.160	0.170	0.179	0.189	0.199
1½	0.091	0.103	0.115	0.127	0.139	0.150	0.162	0.174	0.186	0.198	0.209	0.221	0.233
2	0.111	0.127	0.143	0.159	0.175	0.190	0.206	0.222	0.238	0.254	0.269	0.285	0.301
3	0.151	0.175	0.199	0.223	0.247	0.270	0.294	0.318	0.342	0.366	0.389	0.413	0.437
4	0.191	0.223	0.255	0.287	0.319	0.350	0.382	0.414	0.446	0.478	0.509	0.541	0.573
5	0.231	0.271	0.311	0.351	0.391	0.430	0.470	0.510	0.550	0.590	0.629	0.669	0.709
6	0.271	0.319	0.367	0.415	0.463	0.510	0.558	0.606	0.654	0.702	0.749	0.797	0.845
7	0.311	0.367	0.423	0.479	0.535	0.590	0.646	0.702	0.758	0.814	0.869	0.925	0.981
8	0.351	0.415	0.479	0.543	0.607	0.670	0.734	0.798	0.862	0.926	0.989	1.052	1.117
9	0.391	0.463	0.535	0.607	0.679	0.750	0.822	0.894	0.966	1.038	1.109	1.181	1.253
10	0.431	0.511	0.591	0.671	0.751	0.830	0.910	0.990	1.070	1.150	1.229	1.309	1.389
11	0.471	0.559	0.647	0.735	0.823	0.910	0.998	1.086	1.174	1.262	1.349	1.437	1.525
12	0.511	0.607	0.703	0.799	0.895	0.990	1.086	1.182	1.278	1.374	1.469	1.565	1.661
14	0.591	0.703	0.815	0.927	1.039	1.150	1.262	1.374	1.486	1.598	1.709	1.821	1.933
16	0.671	0.799	0.927	1.055	1.183	1.310	1.438	1.566	1.694	1.822	1.949	2.077	2.205
18	0.751	0.895	1.039	1.183	1.327	1.470	1.614	1.758	1.902	2.046	2.189	2.333	2.477
20	0.831	0.991	1.151	1.311	1.471	1.630	1.790	1.950	2.110	2.270	2.429	2.589	2.749
22	0.911	1.087	1.263	1.439	1.615	1.790	1.966	2.142	2.318	2.494	2.669	2.845	3.021
24	0.991	1.183	1.375	1.567	1.759	1.950	2.142	2.334	2.526	2.718	2.909	3.101	3.293
26	1.071	1.279	1.487	1.695	1.903	2.110	2.318	2.526	2.734	2.942	3.149	3.357	3.565
28	1.151	1.375	1.599	1.823	2.047	2.270	2.494	2.718	2.942	3.166	3.389	3.613	3.837
30	1.231	1.471	1.711	1.951	2.191	2.430	2.670	2.910	3.150	3.390	3.629	3.869	4.109

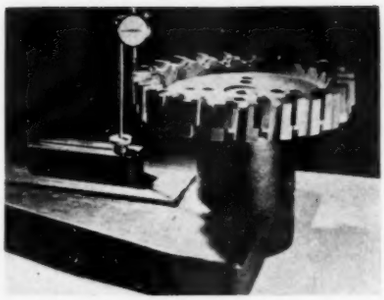


Fig. 14—The run-out on the face of the cutter should be checked carefully on each tooth; keep readings within values shown in Table IV

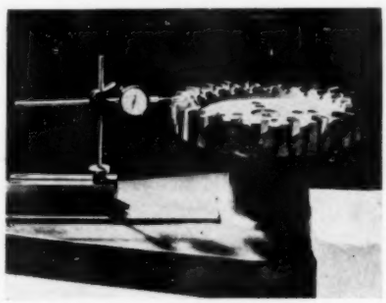


Fig. 15—Check run-out on the outside diameter. No consecutive teeth should have a variation greater than half of the total permissible run-out

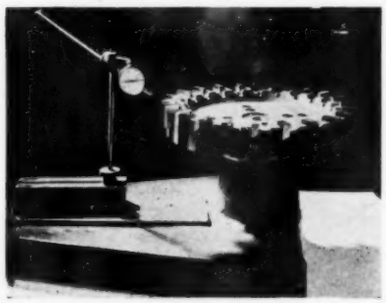


Fig. 16—The run-out of the chamfer should be checked at the corner of each tooth

Photos Courtesy Ingersoll Milling Machine Company

10. *Grind heel*—Swing grinding attachment to desired angle for removing steel at heel of blade on face of cutter. See Fig. 13. Set tooth rest to eliminate interference of wheel with adjacent teeth. Grind teeth so that cut runs out on each tooth $\frac{1}{32}$ in. above braze line, as shown in Fig. 4. Use a silicon-carbide cup wheel.

Inspection After Sharpening

The following procedure should be followed, in general, during the inspection of sharpened carbide-tipped milling cutters: (1) Inspect all carbide tips for grinding checks and chipped faces. (2) Inspect all blade locking devices. (3) Inspect hole in cutter. (4) Inspect counterbore. (5) Inspect back face and drive slots. (6) Inspect cutting clearance on outside diameter, chamfer and side teeth. (7) Inspect side teeth for relation of heel and toe. (8) Inspect cutter for run-out.

Cutting clearance should never be considered as satisfactory because it "looks right" but should be checked with a dial indicator, as in Figs. 14, 15 and 16. If no inspection fixture is available, a dial indicator mounted on a base can be used on the table of a grinder or milling machine. The indicator point should have a $\frac{1}{64}$ in. radius spherical point to aid in finding the contact point.

To use the indicator in determining cutting clearance:

1. Scribe a line $\frac{1}{16}$ in. behind the cutting edge, and parallel to it.
2. Place dial indicator so point is on cutting edge and set dial to zero reading.
3. Rotate cutter forward until scribed line is directly below indicator point. The drop in indicator reading is a measure of cutting clearance. See Figs. 1 and 2, and Table I.

Cutter run-out should be checked with the cutter mounted in exactly the same manner as it was mounted for sharpening and will be mounted when in use. Good practice indicates that the total run-out should be kept within the dial indicator readings shown in Table IV. When inspecting run-out on outside diameter, no consecutive teeth should have a variation greater than one-half of total allowed run-out.

Table III—VERTICAL TILT FOR GRINDING ATTACHMENT

(*When Grinding Side Teeth of Milling Cutters with a Cup Wheel*)

Material	Angle in Degrees Clearance at Cutting Edge	For Rough Back-Off
Aluminum	5	8
Brass	4	7
Bronze	4	7
Cast Iron	4	7
Copper	6	9
Fibre	6	9
Malleable Iron	4	7
Plastics	6	9
Rubber — Hard & Medium	6	9
Steel	4	7
Zinc Die Castings	6	9

Table IV—FACE MILL RUN-OUTS FOR ROUGH AND FINISH CUTS

Cutter Diameter	*Roughing Cuts* Face	*Roughing Cuts* O.D. & Chamfer	*Finishing Cuts* Face	*Finishing Cuts* O.D. & Chamfer
Up to 12″	0.001	0.002	0.0005	0.0015
12″ to 16″	0.0015	0.003	0.00075	0.002
Over 16″	0.002	0.004	0.001	0.0025

Fighting Aircraft Corrosion

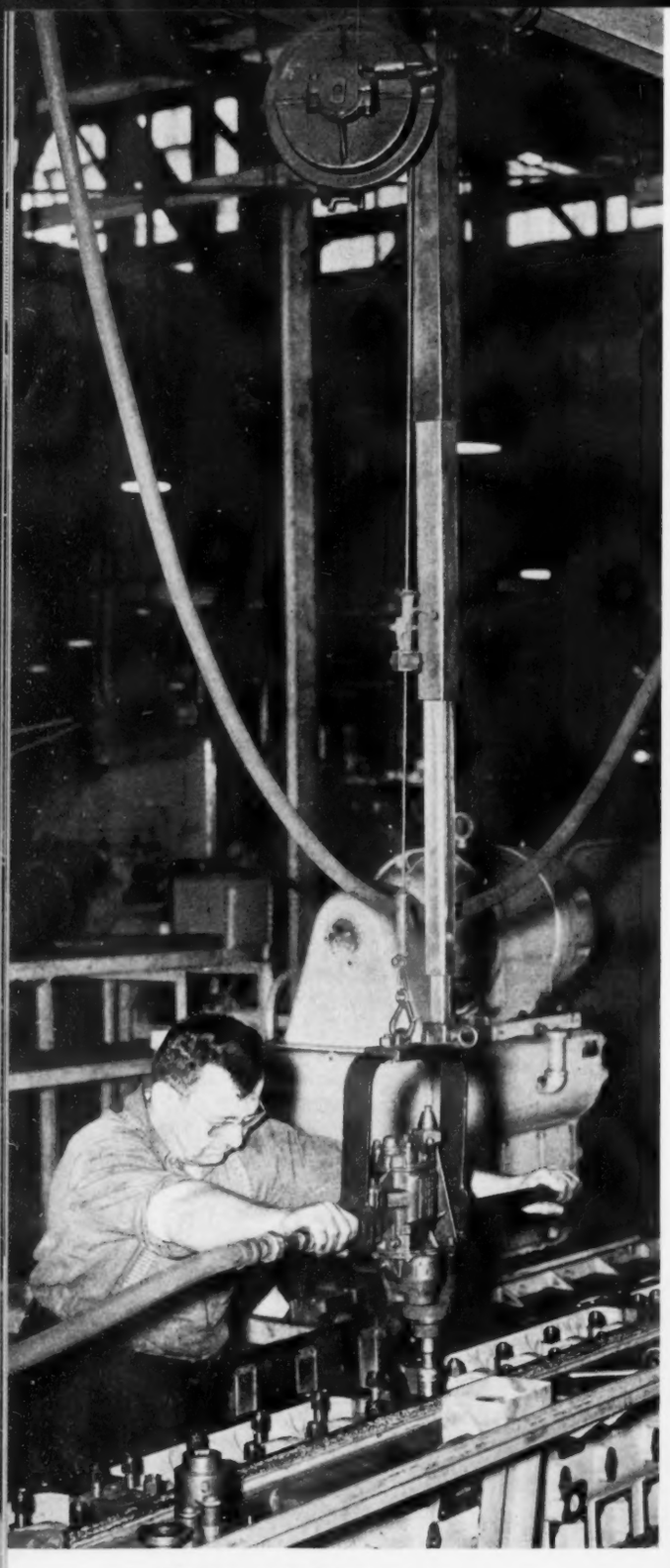
Methods for reducing corrosion of alloys used in aircraft construction have been developed by the National Bureau of Standards in cooperation with federal aeronautical agencies and manufacturers. Methods of heat-treatment have been developed that eliminate intercrystalline attack in aluminum alloys. Also, it has been found that pitting in these alloys can be minimized by making the alloys from high-purity components, and by keeping the copper and iron contents low.

Binary magnesium-aluminum alloys were found to become more susceptible to corrosion as the aluminum content was increased, but small additions of zinc or tin rendered these alloys more resistent to attack. Stainless steel of the 18-8 type, containing small additions of molybdenum, were more corrosion-resistant than similar alloys without addition elements, or those with small additions of titanium.

These conclusions are based on tests of some 25,000 specimens representing 60 different alloys which were corroded by accelerated methods in the laboratory, or by exposure to the weather or to sea water. Loss in tensile properties was used as an index of the amount of corrosion, or it was measured directly on cross-sections examined with the microscope at high magnification.

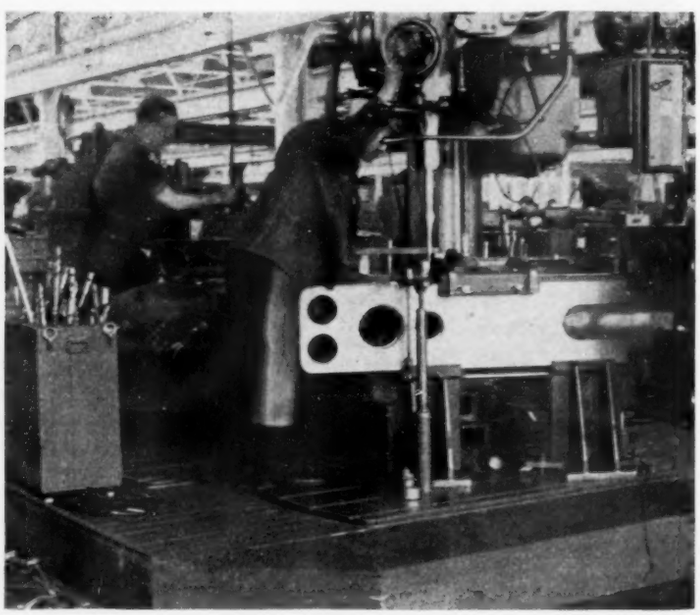
The Bureau of Standards has succeeded in developing surface coatings for both aluminum and magnesium alloys which markedly improve their resistance to corrosion under severe exposures to salt air. Corrosion is affected by riveted joints, gas-welds, seam-welds, and spot welds. Important data also were obtained on the potential effects involved when alloys of different chemical compositions were exposed to corrosion in contact with each other.

Shop shots

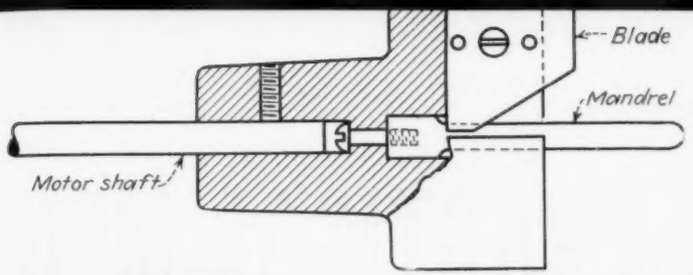


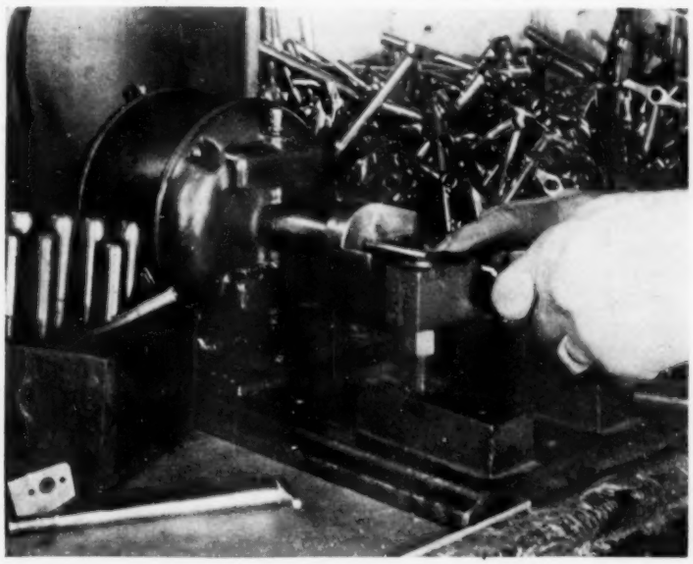
To prevent injury to the operator in case a close-fit main bearing stud series, this air motor is held in a steel yoke which is kept from turning by the telescoping square tubes, while its weight is supported by a spring balance. Bearing welded to end of largest tube pivots on a bar, the ends of which are supported on rollers from an overhead I-beam. Caterpillar Tractor Company

Precision parts are inspected at this bench which is equipped completely enough for the majority of inspection jobs encountered. Gages and inspection tools are kept in orderly arrangement on recessed boards in drawers. Pigeon-holes for papers and records leave the top of the bench free for inspection work. Expensive or infrequently used inspection devices are kept in the toolroom. Wright Field; Official U. S. Army Air Corps photo

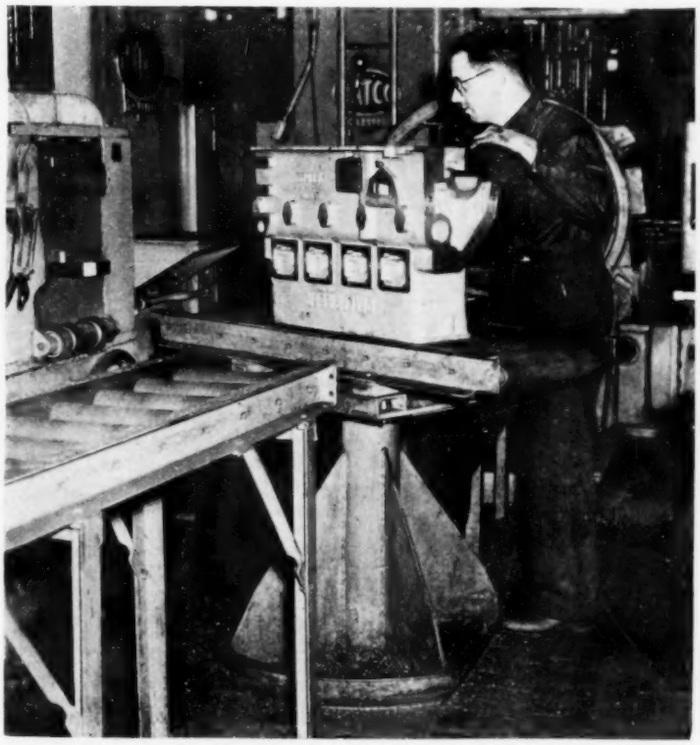


In drilling and tapping holes in large castings, it has been found that production can be economically improved with radial drills by using supplementary bed plates. In this illustration two bed plates are placed alongside the standard plate furnished with the drill. This permits a first-class machinist to perform all necessary operations on one part, while a helper sets up another casting on the other bed plate and puts the jigs in place. With this arrangement it is simple for the operator to move the drill arm from one casting to the next while the helper precedes him in placing the proper jig. A wooden platform built around the bed plate makes it convenient for the operators to move around and enables them to see better. Kearney & Trecker Corporation





This device puts a 45-deg. cutting edge on steel and brass cork cutters in production quantities. The hollow cork cutter is supported on a mandrel of the proper diameter, which is held in the collar along with the high-speed cutting tool, shown in the sketch. The mandrel is grooved at one end to hold the edge of the cutting blade so that it will not ride up on the cork cutter tube without putting the proper edge on it. Cork cutters are supported in the V-block which can be elevated by the two screws to suit the diameter of the cutter. A sheet metal guard, not shown, is placed over the revolving collar to keep chips from flying. Precision Scientific Company



Revolving conveyor section eases the job of changing direction of cylinder block motion along the machining line. Stand pipe and steel plate are welded together to form the base which supports the conveyor section. Conveyor rails are mounted on a welded channel, plate and tube structure. Caterpillar Tractor Company

Time is saved by wrapping electric oven heating elements with resistance wire right at the spot-welding machine. Wire and its spool are held by a yoke fastened to the welder base. After the free end is spot-welded to the metal conductor at one end of the porcelain insulator, the assembly is dropped into slots in a rotating fixture fastened to the welder columns. The slots fit the flat end of the metal conductors. Resistance wire is then wrapped around the insulator by turning the hand crank. After cutting with scissors, the wire end is spot-welded to the element connection. Precision Scientific Company

When threaded parts have been carburized, this arrangement is applicable to a wide variety of parts where it is desired to draw the threads back from the brittle stage. City gas mixed with oxygen is fed to the torch held over the work-table as shown. The operator holds the piece with tongs while turning the threaded portion under the flame. By watching the color of the piece, he can regulate the speed with which the thread must be moved under the flame to get the proper draw. Parts are supported by a bent frame made of steel bar welded to a steel base plate. After this operation, they are air-cooled. Independent Pneumatic Tool Company

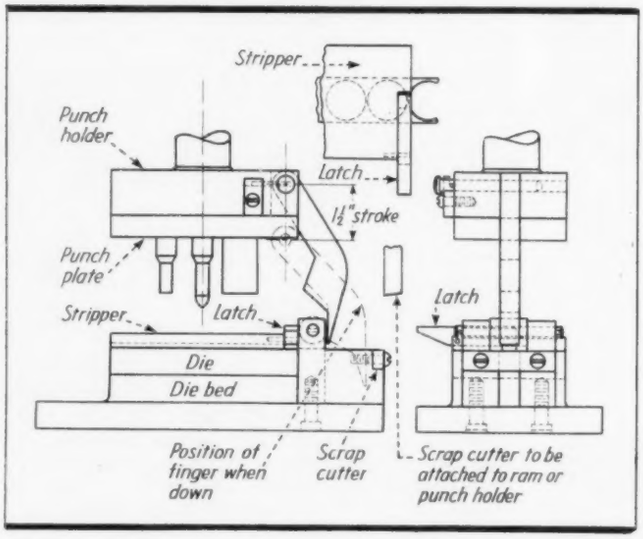
IDEAS FROM PRACTICAL MEN

Finger Feed for Blanking Dies

By HENRY W. FALSTROM
Tool Engineer, Eastern Tool & Mfg. Company

The type of finger feed for blanking dies illustrated has proved itself very practical and dependable. Once fitted, it requires no adjustments. It remains with the die and is not transferable from one die to another.

Shaping and fitting the finger should be done in the press where the die is to be used. A finger fitted to a press with a $1\frac{1}{2}$ in. stroke, cannot be used in a press with a 2 in. stroke. The feed consists of a bracket set in front of the die. This bracket contains a roller for the finger to ride on and also supports the scrap when the finger is feeding. A scrap cutter can also be attached to this bracket as shown. A latch is fitted to the stripper that allows the scrap to go under but forbids it to be pulled back. This latch should drop from its own weight when the heel of the finger is on the center of the roller.



This figure feed for blanking dies hinges in the punch holder or punch plate, and drops back from its own weight during the upstroke of the punch

The finger hinges in the punch holder or the punch plate. It is removable by hand and should have a locking device as shown to prevent it from sliding out. The finger is so hung that it will drop back from its own weight after the up stroke. When stroke is up, the tip of the finger should clear the scrap by at least $\frac{1}{16}$ in. On the down stroke, the finger should enter into the scrap at least $\frac{1}{4}$ in. before starting to feed. When the heel of the finger is on the center of the roller, it is through feeding. The latch drops and the pilot enters. It is well to relieve the finger a trifle as shown in the down position of finger to allow the pilot to index properly.

In starting a new coil of material, take the finger out. Feed enough blanks by hand until the scrap protrudes under the roller. Put the finger back in and start the press.

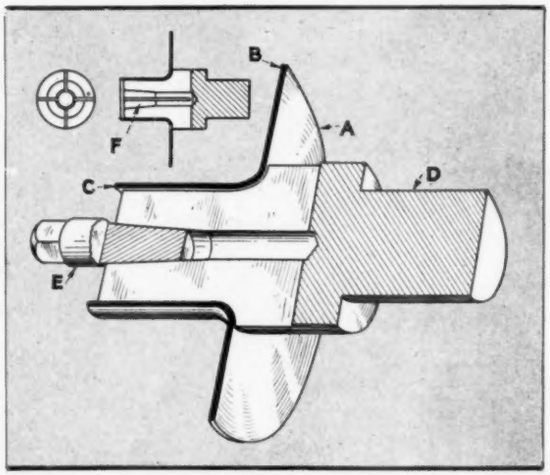
We are using this type of feed on many of our dies and find it very dependable, especially on dies where production requirements are large.

Split Arbor for Trimming Flanges

By E. O. SCHRAY

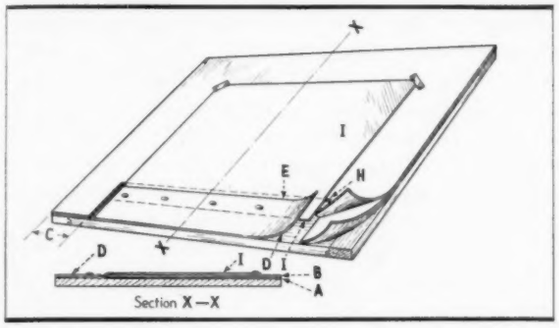
Recently we were confronted with the problem of trimming Flange *A* shown in the drawing at ends *B* and *C* at the same time. It could not be mounted on the chucks we had available because of the large radius. So we made the illustrated split arbor *D*, which worked very satisfactorily. The split arbor has two slots at right angles to each other going about $\frac{3}{4}$ in. further back than flange *A* when it is slipped on. This allows easier expansion.

After flange *A* is in place the tapered pin *E* is driven into the tapered hole *F* with a light blow of the hammer. A 6 deg. included angle on both pin and hole gave the desired performance. After the trimming operation we take a suitable wrench (about 6 in. long) to fit the square at end of pin *E* and give it a



A split arbor, expanded by a tapered pin, was used to trim both ends of this large diameter flange simultaneously. The arbor can be tapered to fit the headstock, rather than chucked in the lathe, if precise concentricity of the flanges is desired

quarter turn, which is enough to loosen and remove the flange without dropping the pin. Arbor *D* was held in a chuck, but could be made with a taper to fit the headstock of the lathe to insure greater concentricity on repeat orders. Arbor *D* was made of cold-rolled steel and pin *E* of drill rod hardened and tempered to stand a blow on the square end.



Heavy manila paper mortised as shown can be used to prevent the bottom edge of the vellum from curling or tearing by the movement of tools and straight edges

Prevents Edges of Vellum From Tearing

By DONALD A. BAKER

Vellum drawing paper is brittle and easily torn, especially along the bottom edge where tools and straight edges are constantly being moved over it. To eliminate this trouble I cover the top of my drawing board with two sheets of heavy manila paper *A* and *B*. Rectangular sections are cut from sheets *A* and *B* near the bottom of the drawing board. The height of the rectangular section depends on the location of the lower edge of the vellum when placed on the drawing board, while the width of the section is made a little larger than the maximum width of the largest piece of vellum to be used. This leaves margins *C* on both sheets *A* and *B* which extends from the bottom of the board to 3 in. above the bottom edge of the vellum. One of the rectangular pieces cut from sheets *A* and *B* is discarded, while the other is located at *D* in the drawing; however, the piece is trimmed to form margins *E* and *H*.

In use, a sheet of drawing paper *I* with border lines previously drawn, is placed on top of sheet *B* and the lower edge is slid under strip *E*. The border lines are adjusted by straight edge, and it is then tacked or held in place with gummed tape. With this arrangement, the straight edge slides smoothly over the piece, since there are no raw edges to curl up and catch.

Use an Air Motor to Raise a Shaper Table

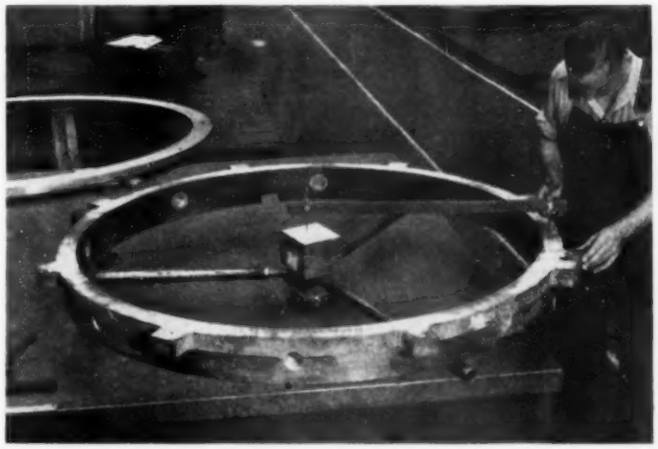
By EDWARD N. OLSON

There are shapers today which still lack an automatic mechanism for elevating the table. A No. 3 air motor will do the job quickly when fastened to the shaper table screw shaft. Of course, this will not lower the table, but the weight of the latter will assist greatly in this operation. I recently operated a 26-in. shaper, and had to move the table its maximum distance. The air motor simplified the job.

Ball Bearing Spider Improves Layout Table

A simply-constructed work support recently developed by Victor Sherwin at the East Pittsburgh Works of Westinghouse Electric & Mfg. Company permits the workman to stay at one convenient location and rotate the piece being marked at will. This fixture is suitable for laying out circles on large pieces.

Three steel bars of sufficient strength to support the work are welded in spoke-like fashion to a steel block. This block is then set on a ball thrust bearing which is placed on the layout table. Steel pipes may be slid on the bars to increase the working diameter of the assembly. The bearing assembly shown in the accompanying illustration has supported pieces weighing four tons.



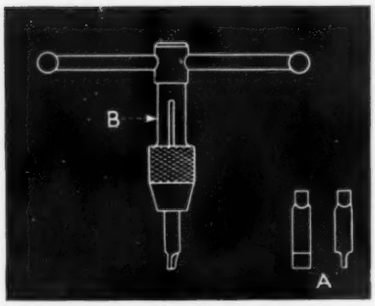
Three steel bars, welded to a steel block, and a ball thrust bearing make up a convenient fixture for holding circular parts to be laid out for machining. It will hold work weighing four tons

To find a center a flat steel block with a center punched in it is laid on the bearing assembly as shown. The block then is moved about on the bearing until the correct center is found. Not only does this fixture save the workman's time, but it reduces effort in laying out large pieces brought to the table.

Screwdrivers for Close Quarters

By C. F. FITZ

In our assembly and maintenance work there are many screws to be inserted or removed from very odd, difficult and inside places. To overcome this difficulty we made sets of screwdriver bits, as shown at *A* in the accompanying illustration. They were made from worn or broken taps and had the squares left on the shanks and were held in an ordinary T-handled tap wrench



Screwdriver bits held in a key-type wrench having a sliding T-handle can be used in close quarters. The bits are made from worn or broken taps

having a sliding handle, as shown at *B*. The use of these screwdrivers not only increased the efficiency of the workmen, but prevented the slots in the screws from being chewed up, as they would be by an ordinary screwdriver held at an angle.

Ingenuity Plus Welding Saves Money

By ARTHUR HAVENS

I am at loss to explain the surprising number of ingenious devices made by welders. It may be that the extreme flexibility of the welding trade has something to do with it, or the welders have some special inventive ability—probably a combination of both. At any rate, every shop I visit the same conditions exist—most of the shop oddities are welded. Here are some examples of how welding saved a railroad shop money.

It had always been the custom in the shop where I was recently employed to roll the superheater flues on the firebox end by hand. This was necessary because of the cramped quarters in the firebox. One day while watching a boilermaker and his helper sweat and strain on a big roll, a welder suggested that they weld two air-motor collets to a length of $1\frac{1}{2}$ in. pipe, making the pipe long enough to reach to the deck outside the firebox door. Willing to try anything to help make this job easier, the suggestion was followed. Two helpers were stationed on the deck to operate the motor and the boilermaker stayed inside to guide the roll; needless to say this idea proved a boon to the boilermakers, and resulted in reducing the time necessary to roll the complete set of superheater flues.

Removing loose driving wheel keys in the enginehouse often presents a difficult problem to the unlucky mechanic who gets the job. However, this can be simplified by following the advice of a welder. A bolt with a body size slightly smaller than the key is scarfed welded to the end of the key with the threads protruding. Over the bolt is placed a piece of tubing or washers, just leaving enough of the bolt for a full nut. By taking a strain on the nut, the key will come out easily. It is a simple matter to add more washers or change the length of the tubing until the key is removed.

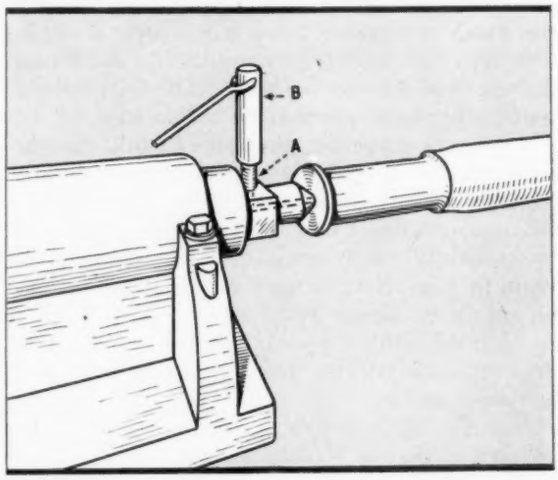
When a railroad is in receivership, the stores department may accept devices made from scrap material. Take an oil cup for instance. The welder rolled a piece of iron into a cone and welded thereto a $1\frac{1}{2}$x$2\frac{1}{2}$ in. nipple for screwing the cup into crosshead guides. Since curled hair is used in such oil cups, two pieces of $\frac{1}{8}$-in. rod were welded across the top of the oil cup to keep the hair from falling out. Just another idea that saved money for a railroad that needed it badly.

Railroad mechanics frequently have a difficult time removing packing from a gland with the conventional packing hook. Here's a tool that seldom fails to do the job. Scarf the end of a 12-in. length of $\frac{1}{4}$-in. welding rod and weld on a large wood screw from which the head has been removed. On the other end, weld a $\frac{1}{4}$-in. rod fashioned into a ring about 2 in. diameter. If you prefer, weld a piece of rod for a T handle. This tool is screwed into the contrary packing, and with a sharp yank on the handle, out comes the packing. Granted, the packing has been destroyed, but this is also usually true when it is removed with the conventional packing hook. These examples illustrate the welder's versatility in making money-saving devices.

Greasing Axle Lathe Centers

Rolling car and locomotive axles with a single roller puts a heavy pressure on the lathe centers. Borrowing the idea from the pressure grease lubricators used on connecting rod ends, the Frascati shop of the Gulf, Mobile and Northern railway in Mobile, Ala., have an effective way of keeping these centers greased.

Taking a short, hollow staybolt, they screw it into one side of the square of both lathe centers—for it is a



A grease cup made from a hollow staybolt and brass bushing serves effectively to lubricate centers on a journal-turning lathe

double ended, center drive axle lathe by Putnam. The center has a hole which leads from the staybolt to the point. A long brass bushing is tapped to fit the staybolt and a swiveling handle is fitted to the blank end.

A grease stick is put in the brass bushing which is screwed on the stud. This forces grease to the center and it can't help working back between the axle and the cone point. It has proved a simple and efficient way to prevent undue wear and scored centers.

CHALLENGE TO INDUSTRY'S PATRIOTISM

Calls for Plain Speaking

IT is a pity that the greatest national defense effort in American history had to be made during a presidential election campaign. For a modern defense effort involves an intensely practical industrial project, while an election campaign involves an intensely emotional political propaganda. And those two don't mix.

That, as I see it, is the chief reason for the welter of claims and denials, charges and counter-charges that have been getting in the way of contracts for planes, tanks, guns and all the rest of the armament for which the American people are so nervously peering down the road.

We are told that the managers of industry, smarting and suspicious under the repeated attacks of government officials for some years back, have been reluctant to assume the abnormal risks of defense contracts without commensurate safeguards, and that the politicians who must authorize those safeguards have been reluctant to do anything that might be construed as letting down the bars for unscrupulous business men to exploit the national emergency. For the one, the business risks of full speed ahead have been too great; for the other, the political risks of full speed ahead have been too great. So we don't go full speed ahead.

This is not written to increase that clamor of recrimination on either side. On the contrary, it is an appeal for some decent and thoughtful consideration on the part of all concerned—consideration for the urgent needs of the nation, for the problems and responsibilities of both the politicians and the industrialists, for the elementary principles of prudent business management, and for the good opinion of the man on the street. He is neither a politician nor an industrial executive. But his hide and his pocketbook are at stake in the national defense program—and he knows it. He has a right to the low-down on what is going on. And if he is left in ignorance or deliberately deceived, for the sake of either political or business whoopee, the payoff will be mighty poisonous political medicine for the politicians and equally poisonous business medicine for the business men who may be responsible.

* * *

The plain stark fact, to be faced squarely by us all, is that the national defense program is an emergency project—a desperately urgent emergency project.

As in every emergency that confronts a democracy, we are harassed by a confusion of counsel. As always, some of the confusion arises from honest but conflicting judgments, some of it from ignorance or muddy thinking. But, unhappily, much of it reflects the deliberate purpose of self-seekers to fish in troubled waters—to capitalize the conjunction of a national emergency and a political campaign to boost their own interests. Already the charge that American business men are unpatriotic and interested only in profit has been put out as a smokescreen to cover up deficiencies for which business men are in no way responsible.

Now the man on the street finds it hard to see through this maze of excited contradiction. Not because he isn't smart—the average American can think straight enough *when he has the facts.* But in this case the facts are obscure and complicated—they have to do with matters that are strange to him. And to make it worse, at the height of his confusion, raucous voices constantly assail his ear with "simple" explanations of it all. But, as so often happens, most of these "simple" explanations make the matter a lot simpler than it really is.

* * *

Consider, for example, the cry that "industry refuses to get busy on national defense until its profits are guaranteed". Very clear and simple, to be sure; but also very false. The charge that American capital is "on strike" in the hour of national need. As silly as it is simple. The assertion that our manufacturers "won't even talk with a government anxious to place orders with them, without large financial concessions", and that "American corporate industry refuses to expand its resources for defense until it receives immunity from proper taxation". The resounding demand that we "conscript wealth as well as men"—whatever that may mean.

Particularly political has been the attack on the aircraft industry. It has been made to appear that aircraft manufacturers were instituting a sit-down strike because, in their greed for profits, they demanded more than 8%. Actually the 8% was not a net profit at all and the only concern of the manufacturers was to fight against incurring losses under the 8% limitation. And army and navy officers have sustained the aircraft manufacturers' viewpoint.

The air is full of explanations which, however simple they may sound, do not explain. And in most cases, I am convinced, the purpose of those who offer them is not to explain but to inflame. Those who try honestly to explain these issues from either side, find it impossible to do the job in such ringing phrases.

As I have said, our country has been caught short. As

a result, there are many reasons for the confusion and controversy. The plain fact is that we can produce our war equipment by only two means: (1) by converting the industries of peace into the industries of war, so far as that is possible; and (2) by building from scratch the new facilities we need to supplement them. In other words, we must create—with desperate haste—a new industry in America—an armament industry.

Right there is the crux of the problem that now confronts the industrialist sincerely trying to equip himself for his part in national defense. For this new armament industry is not the ordinary business risk against which he has learned to weigh the interests of his employees and his stockholders. It does not deal with familiar products and processes. It is not continuous—at least it has not been heretofore in this country—and it may fold up as suddenly as it has opened. It cannot hope to serve thousands of potential customers: it has but one sure customer—the United States Government—and wielding the sovereign power that customer can do just about as it pleases with respect to its needs and demands. Which means that not even this one is a *sure* customer.

* * *

No more unfair or deceptive charge ever has been leveled against American industry and American business men than the accusation of being unwilling to take the normal business risks of the defense program. The risks they are trying to minimize—they cannot possibly avoid them all—are very special and extraordinary risks indeed. So clearly is that true, that I doubt very much whether such questions and charges ever would have risen were it not for the fact we are engaged in a political campaign.

Already some of industry's great units have gone ahead with the building of new facilities, the purchase of special materials, and the actual production of armament in the face of all risks, gambling that their government eventually would work out some reasonable plan to protect them against excessive loss. Others, doubtless will follow suit.

But many other companies, for one reason or another, are not in position to do that. So before they begin to expand their facilities to handle defense contracts, they have asked their *only potential customer for those new facilities* to guarantee them—*not* excessive prices, *not* exorbitant profits, *not* immunity from taxation, as we are being told, but simply against the excessive losses that may result from very extraordinary conditions.

* * *

As this is written, it looks as though the legislation and the rulings necessary to accomplish this purpose soon will be forthcoming. Thoughtful and responsible officials of the government understand the situation and what is needed. But, unfortunately, their understanding and action will not quiet the professional business-baiters. So long as those gentlemen have their own interests to serve, so long as political excitement makes it easy to whip up public demand for a scapegoat to atone for disappointing progress with the defense program—just so long will the business-baiters find a receptive audience for their criticisms.

All of which suggests that business men must carry at this time a double responsibility, in addition to their obvious obligation to do the very best job they know how on their individual parts of the defense program.

The first of these added responsibilities is, of course, to avoid any possible basis for the charge that industry is exploiting the defense program in behalf of excessive profit, unfair treatment of labor or any other unworthy self-interest. The second is to see that the man in the street knows and understands all that I have tried to set down in the foregoing.

For the man in the street is deeply involved in all this. He is "in the street" only to the political orators. To the rest of us, he is the man in the factory, the man on the truck, and the man behind the orders that industry fills. In short, he makes up this living American industry on whom the politician's charges spatter. As an employee he has a stake in the solvency, the security, and the reputation of the very plants at which criticism may be directed. Knowing the facts, he can answer the critics so far as his own plant is concerned and can see how the same kinds of facts apply to all industry. If he is a customer, suffering inconvenience as a result of the plant's service to national defense, a knowledge of the facts behind the plant's problems will help to make him a defender rather than a critic of responsible business management. If he is a neighbor in the community, the facts will equip him to be an interpreter of industry's problems to the people of the home town.

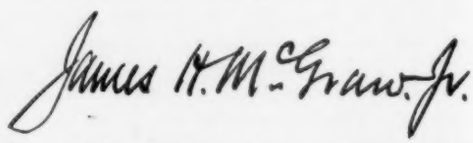
* * *

In this national defense effort, business enters into a new partnership with government, but, more importantly, into a deeper partnership with the American people. It is more than ever essential that it take all of the American people into its confidence, beginning with the people in its plants and going out through the ranks of its customers and its community neighbors to show them that they have a common interest in seeing that the task of national defense is undertaken in the American way.

As we all know, there are in this country some people who would like nothing better than to see American industry fail in this supreme test of service to the nation. They will watch with jealous eyes every move of every company that is engaged on a defense job. They will disparage its achievements, exaggerate its shortcomings, and distort its motives. For they would like to make over American industry to their own pattern, and they'll never have a better chance to get started with it than has been opened up by the national emergency. Or so it looks to them.

So, great as are the business hazards of the defense program for the individual business man, even greater hazards are involved for American industry as a whole. But, knowing the temper of American industrial leadership as I do, I am confident that it will handle its defense assignment with credit to itself and with great advantage to the nation that it serves—whether in war or in peace.

To help in that supreme test is the opportunity and the privilege of the McGraw-Hill organization.



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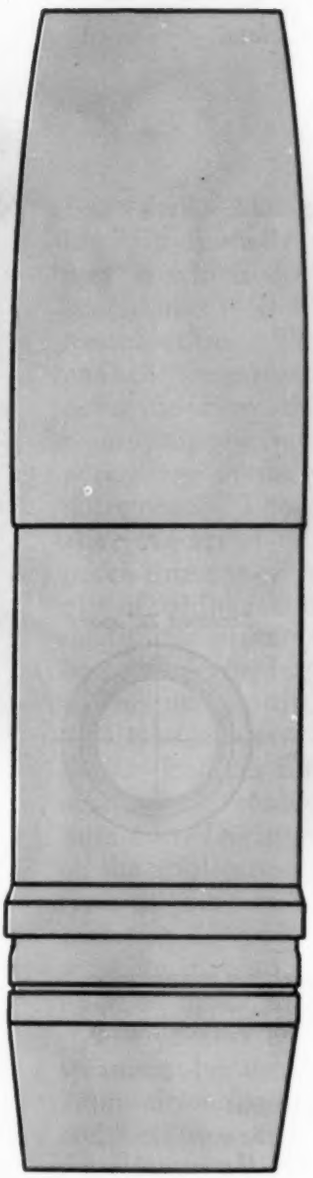
Armament

SECTION OF AMERICAN MACHINIST



HOW TO MACHINE 75 MM SHELL

A PRACTICAL WORKING MANUAL DESIGNED TO GUIDE PRIVATE INDUSTRY IN TOOLING UP FOR THE MANUFACTURE OF SHELL

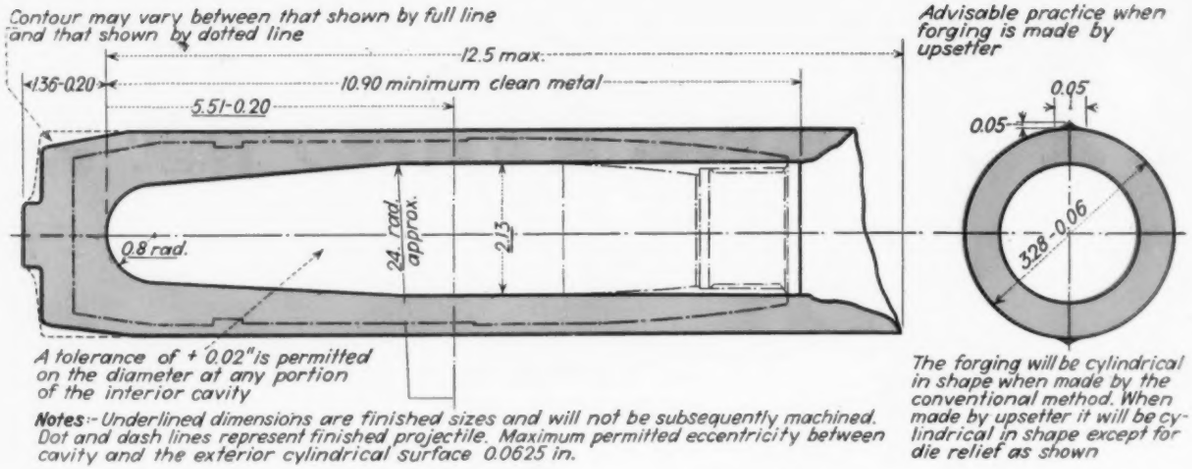
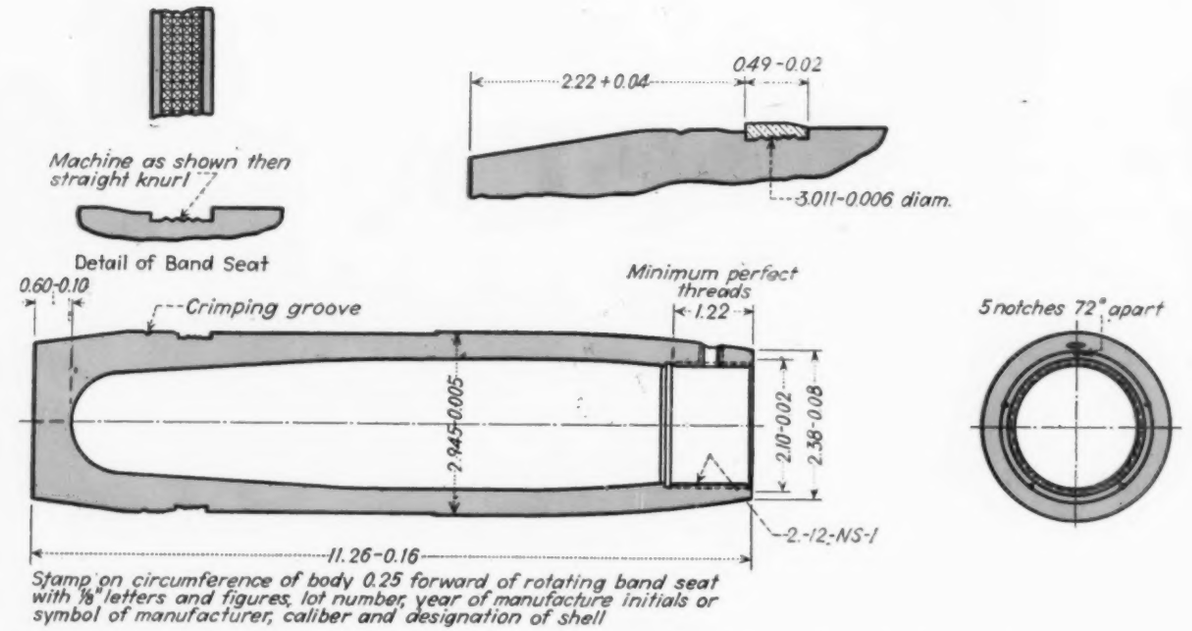

Contour may vary between that shown by full line and that shown by dotted line
12.5 max.
1.36-0.20
10.90 minimum clean metal
5.51-0.20
0.8 rad.
24 rad. approx.
2.13
A tolerance of + 0.02" is permitted on the diameter at any portion of the interior cavity
Notes:- Underlined dimensions are finished sizes and will not be subsequently machined. Dot and dash lines represent finished projectile. Maximum permitted eccentricity between cavity and the exterior cylindrical surface 0.0625 in.
Advisable practice when forging is made by upsetter
0.05
0.05
3.28-0.06
The forging will be cylindrical in shape when made by the conventional method. When made by upsetter it will be cylindrical in shape except for die relief as shown

FIG. 1—*The shell forging is made of SAE X1340 steel with the following minimum physical properties: yield point 55,000 lbs. per sq. in., elongation in 2 in., 15 per cent; reduction of area, not less than 30 per cent*



Note:- Shell must be carefully centered during the various machining operations, in order to maintain concentricity of cylindrical surfaces. The following max. eccentricities of cylindrical surfaces will be accepted
1. Between fuze seat or adapter seat threads and outside cylindrical surface, 0.015
2. Between bourrelet and rotating band with shell body, 0.006 (bourrelet must overlap body on entire circumference)
3. Between cavity of shell and and outside cylindrical surface, 0.015
4. Between base cover and base of shell, 0.03

FIG. 2—*The completely machined shell has a gliding metal rotating band rolled into the knurled seat and a No. 22 gage cover seam welded to the base. It weighs 10.97 lbs. empty as against 20 lbs. maximum for the forging*

HOW TO MACHINE 75-MM. SHELL

This is the first of a special series of authoritative articles describing the manufacture of armament and other products needed for national defense

BY CHARLES GRAZIOSO

Chief Engineer, Artillery Ammunition Division, Frankford Arsenal

FRANKFORD ARSENAL'S set-up for machining 75-mm. shells is a good example of the way in which the Ordnance Department contributes to the technique of munitions manufacture. The arsenals, unless expanded to extravagant proportions, can never be more than pilot plants, which would supply in war time only a small percentage of the country's munitions requirements. They serve, however, to keep alive the art of munitions making during peace time; they furnish a source of supply of ordnance materiel; and they are models for private manufacturers working on ordnance orders.

This article discloses for the first time details of modern tooling for the 75-mm. shell. It gives the findings of 2½ years of intensive study by the Artillery Ammunition Division, Frankford Arsenal, on the application of present-day machine tools to this size of projectile. The presentation is designed to be a practical working manual for private plants called upon to make shells.

The 75-mm. shell was selected for this treatment because it is the size of artillery ammunition made in the greatest quantity and because of all ordnance items, shell manufacture is subject to the most drastic expansion during an emergency. Many of the machining operations performed on this shell are similar to those used on larger and smaller sizes.

An idea of the contribution made by the Ordnance Department to the technique of manufacture may be gained by the fact that it is now possible to make 3000 shells per 8-hr. day with only 41 machine operators. This is not theoretical, but a statement of Frankford Arsenal's actual performance. Machine tool investment for this output is slightly more than $500,000.

Credit for development of these methods goes to the personnel of the Artillery Ammunition Division, Frankford Arsenal, to machine tool and small tool manufacturers and especially to Lieut.-Col. L. H. Campbell, Jr., formerly officer in charge of this department, and now on duty in the office of the Chief of Ordnance, Washington, D. C.

Shell forgings, Fig. 1, are made by commercial forging plants, either by the conventional pierce and draw-bench method or by means of an upsetting machine. The steel is equivalent to SAE X1340. The forgings are furnished to meet specified physical properties: yield point—not less than 55,000 lb. per sq. in.; elongation in 2 in.—not less than 15 per cent; reduction of area—not less than 30 per cent. Main-

tenance of these physical properties in the forging avoids the heat-treatment during the machining operations that was formerly practiced. This arrangement has resulted in a great saving in time and equipment, and has eliminated one of the choke points in shell manufacture.

Another great saving is the making of forgings with the interior cavity corresponding to the finished shell dimensions, Fig. 2, thus eliminating boring operations to machine this cavity to size. The boring operations proved to be another choke point during the last World War.

The first operation to be performed at Frankford Arsenal is to shot blast the interior surfaces of the forging to remove all scale. The forging is then ready to start its journey through the machining department.

Special Mandrel for Centering

Centering is the second operation; it must be carefully performed to insure concentricity within the limits of specification as all succeeding operations are dependent upon it. To center, the forging is placed on a six-jaw expanding mandrel, hydraulically or air-operated as shown in Fig. 3. The three jaws at the end of the centering arbor grip the interior of the forging first, as they are positively actuated. The three jaws at the rear of the mandrel are controlled by an equalizing spring which compensates for any draft in the interior forging dimensions. The expanding jaws are made from 0.90 carbon tool steel and hardened; they are ground in place after the mandrel has been fitted to the machine spindle, insuring accuracy in the working position. The centering arbor body and other details are made from high grade chrome-nickel steel which is heat-treated. The arbor is tested daily by means of an accurately finished master shell, using a dial indicator to check the concentricity of the outside surfaces. The forging is rotated in the machine counter-clockwise while the centering drill is rotated clockwise.

The third operation is that of machining the base, cutting off and turning for concentricity. This operation is performed on a multi-tool lathe with a swinging tailstock as follows: The forging is chucked on a three-jaw expanding arbor locating from the cavity, while the tailstock is swung into position in the center as shown in Fig. 4. A convenient feature of the set-up used at Frankford Arsenal is a work shelf that fits on the swinging tailstock. When the tailstock is swung backward out of position, the shelf comes into line with the expanding arbor affording a handy means of unloading and reloading the work.

The tools used in this operation, namely the driving arbor and jaws, are manufactured from chrome-nickel steel and 0.90 carbon tool steel respectively. Three carbide turning tools are located on the front slide of the machine, and two additional carbide tools are mounted in the back arms—one for base facing, and the other for cutting off the excess stock from the open ends.

The fourth operation is known as "nosing-in the open end." This operation is done by cold pressing in a crank press of 180-ton capacity with a 16-in. ram. The shell is placed in the collet and die set, shown in Fig. 5. The ram of the press descends upon the open end of the shell, and the collet is clamped around the shell as soon as the upper part of the die strikes it. The collet bottoms on a sleeve to limit its motion, while the die forms the nose of the shell to produce the correct inside radius. The die is made from steel which can take abuse without scoring and is banded by a machine steel ring to prevent shattering. Tallow is used as a lubricant in this operation.

The fifth operation is to finish turn the exterior surfaces of the shell. This operation is performed on a vertical two-slide turning machine with form plates on each slide to guide the tools so that the correct exterior contour is produced. A locator is placed in the shell and then both shell and

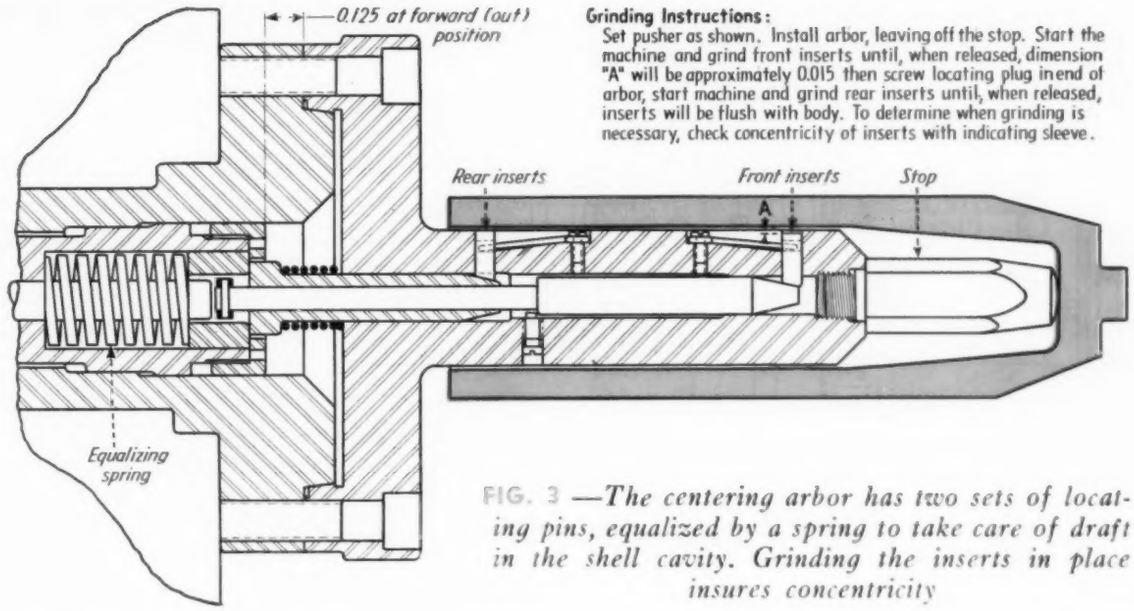

0.125 at forward (out) position
Grinding Instructions:
Set pusher as shown. Install arbor, leaving off the stop. Start the machine and grind front inserts until, when released, dimension "A" will be approximately 0.015 then screw locating plug in end of arbor, start machine and grind rear inserts until, when released, inserts will be flush with body. To determine when grinding is necessary, check concentricity of inserts with indicating sleeve.
Rear inserts
Front inserts
Stop
A
Equalizing spring

FIG. 3 —*The centering arbor has two sets of locating pins, equalized by a spring to take care of draft in the shell cavity. Grinding the inserts in place insures concentricity*

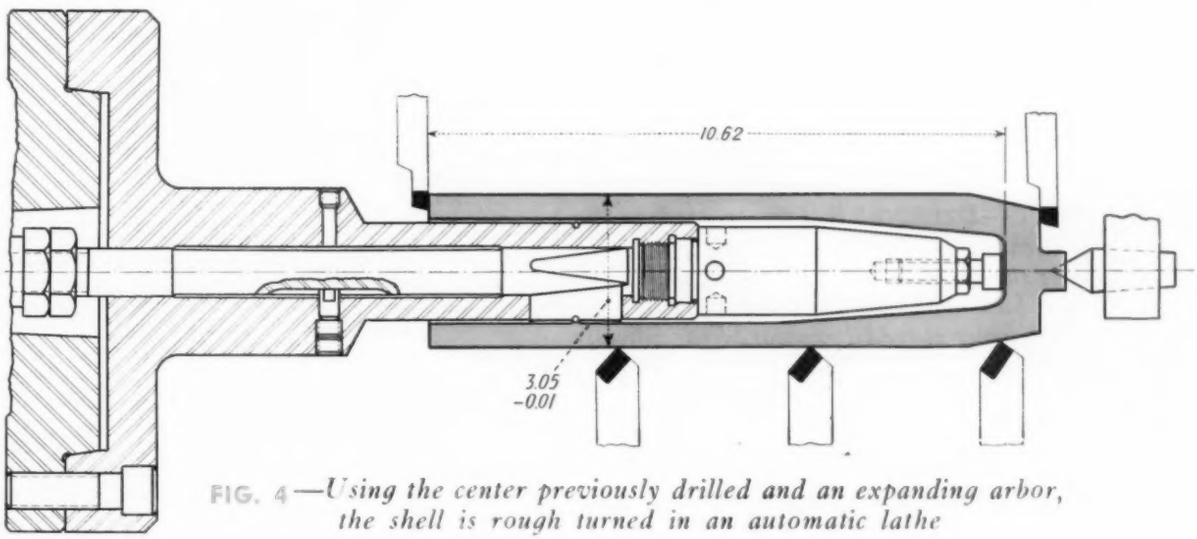


FIG. 4 —*Using the center previously drilled and an expanding arbor, the shell is rough turned in an automatic lathe*

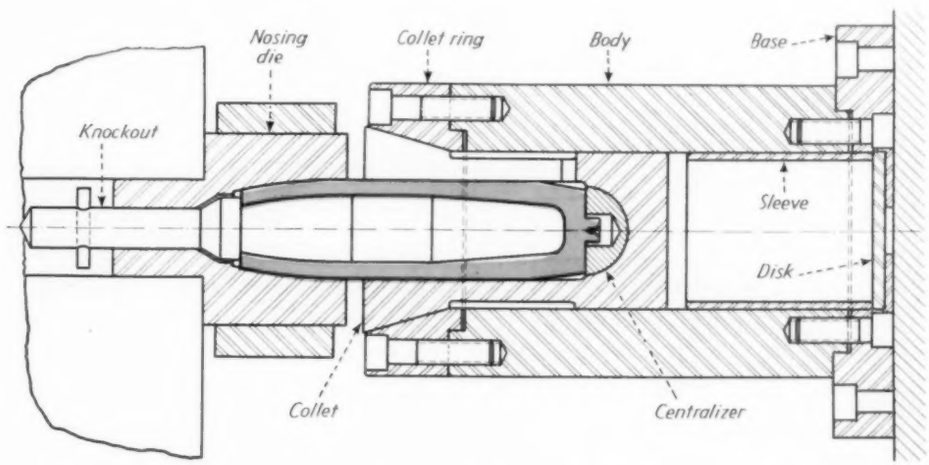


FIG. 5 —*The nose of the 75-mm. shell is cold formed in a crank press while held in a vertical collet*

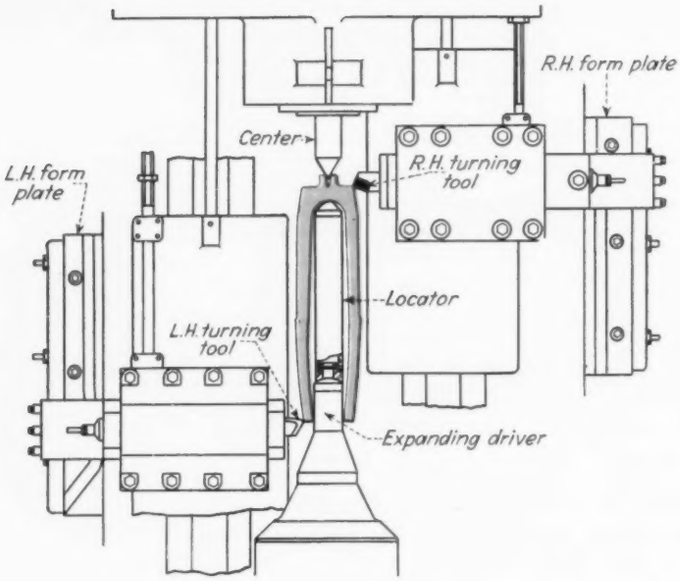


FIG. 6—*Finish turning the O.D. is done in a vertical lathe which uses two carbide tools feeding upward and downward respectively*

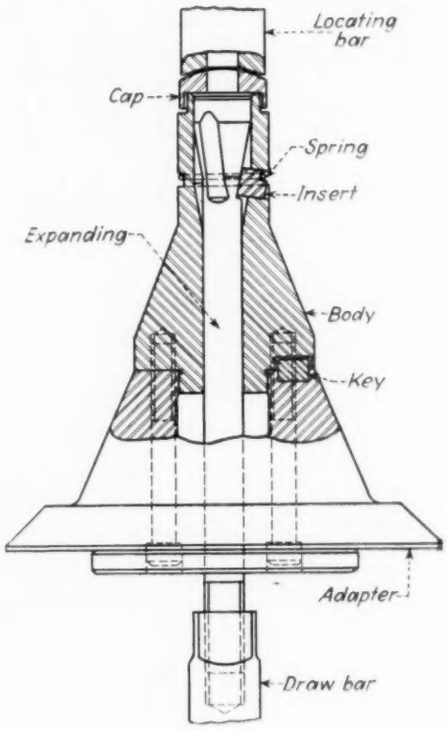


FIG. 7—*Details of the driver used on the vertical lathe shows the locating bar, which fixes the height, and the expanding inserts. The base of the shell is supported by a dead center moved downward hydraulically*

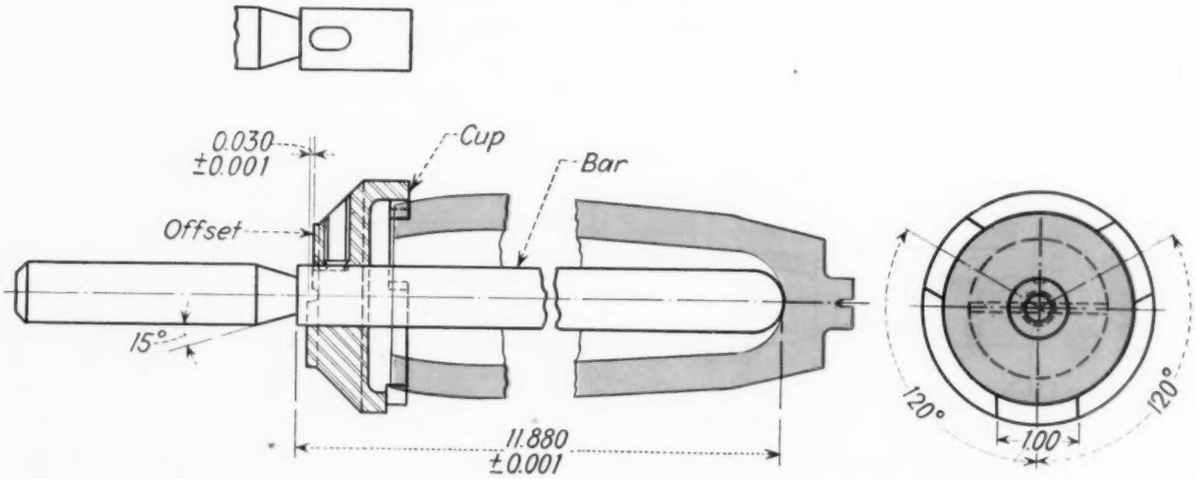


FIG. 8—*A special gage shows whether the O.D. at the point of final trim is the correct distance from the base of the cavity. The cup is loosely held on the gage bar, the shoulder of which must fall within the 0.030 in. offset when the cup is in contact with the work*

locator are placed over the expanding driver. Expanding inserts, in the driver, chuck the inside contour of the shell while the tailstock is automatically brought into position. Both expanding driver and tailstock are hydraulically operated. This method of chucking locates the work from the bottom of the cavity.

The right and left-hand turning tools are then fed along the shell following their respective forming plates as shown in Fig. 6. A cross-section view of the driver is shown in some detail in Fig. 7. The gage, Fig. 8, locates from the interior of the cavity to measure the diameter across the nose at a point where the shell is subsequently faced. This gage consists of a bar with a spherical end, which strikes the bottom of the cavity, and a loosely supported ring with three contact points which rest upon the outside diameter of the shell a short distance from the nose. The back of this ring is offset over half its area. A shoulder in the plug must fall within the upper and lower limits of this offset, a distance of 0.030 in., in order to have the work pass inspection.

Operation No. 6 is that of drilling and tapping the lock screw hole. This operation is performed in a two-spindle drill press with the shell located from the inside bottom on a sliding jig shown in Fig.

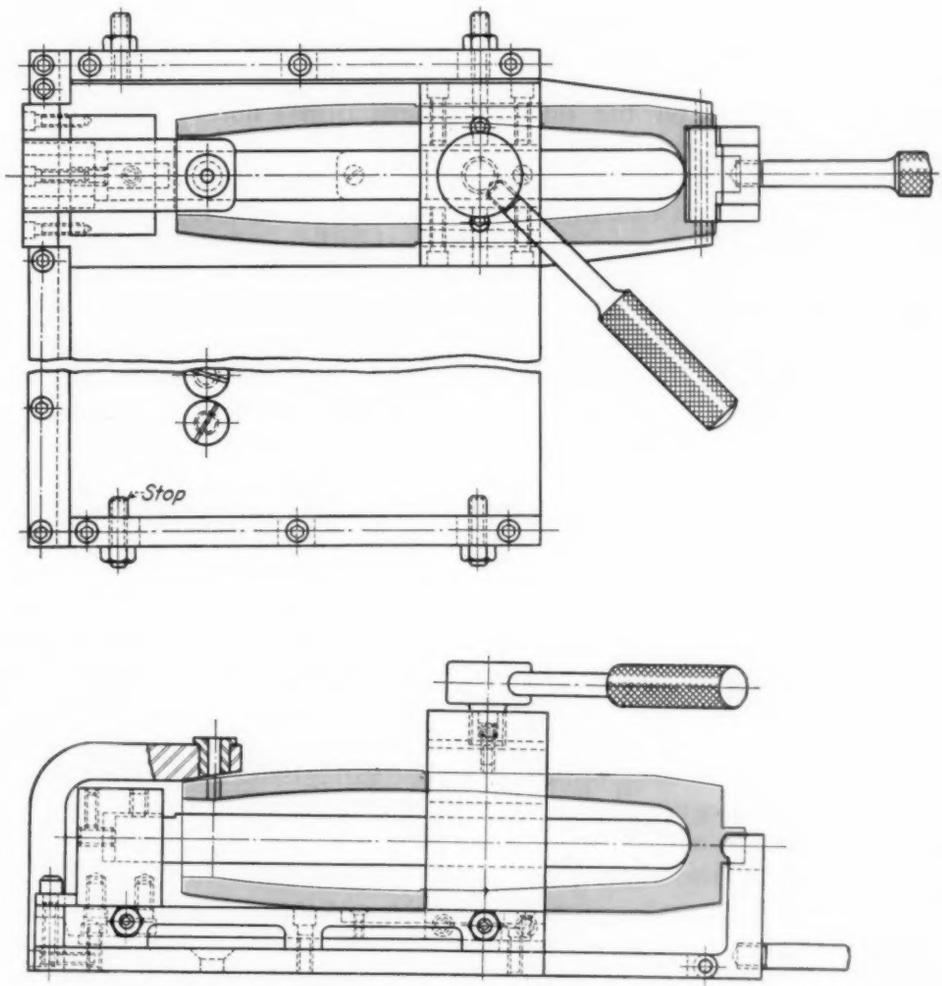


FIG. 9 —*After being drilled in the position shown the shell is moved in its jig against the opposite pair of stops for tapping the set screw hole*

9. Drilling is done with a size G drill through a fixed bushing. Then the locating portion of the jig is slid along the base plate against a pair of stops which brings the hole directly beneath the tapping spindle. A hand fed floating tap cuts the 18-pitch lock-screw hole with the use of a tapping attachment. The only thing to remember in connection with this operation is that it should be performed before cutting the larger thread which forms the fuze seat. If the lockscrew hole is cut after the larger thread it will raise a burr that is difficult to remove.

Finished on Multi-Spindle Machine

The seventh operation entails finish machining both ends of the shell. It is performed on an eight-spindle double indexing machine. The shell is placed in the eighth station, locating from the base of the cavity and chucked on the outside diameter. It is then indexed to Station 2, where a carbide tool rough faces the base; then to Station 4 where an end mill machines the lug to the rough face base thickness; meanwhile, a carbide form tool forms the band seat grooves and the cartridge case crimping groove. At Station 6, the base of the shell is finish faced to the correct specified thickness. These operations are illustrated in Fig. 10.

After the shell is machined on the base end, it is removed from the chuck in the eighth station; it is inverted and placed in Station 1 with the open end out, where it is located from the outside base and chucked on the outside diameter. At Station 3 the open end is rough bored and rough faced; at Station 5 the open end is reamed to 1.9098 plus 0.0090 in. diameter, making the shell ready for the tapping operation. In this position the open end is chamfered by a carbide tool. At the last station of this machine, the shell mouth is finished faced to the correct depth and tapped with a collapsible tap. Fig. 11 shows the machining up to this point.

The device, shown in Fig. 12, is used throughout the machining operations in order to insure that concentricity is maintained in the shell. It consists merely of a pair of rollers and a finger-type indicating gage. As the shell is rotated on the rollers, any runout becomes at once apparent. A slide permits the shell to be placed at various positions in order to check different points along cavity.

Notching is done next on the fixture shown in Fig. 13. This work is done on a hand feed milling machine. The shell is placed in the notching fixture and is chucked by rotating handwheel *A* clockwise until tightened. Then feed handle *B* is brought forward bringing the table against the stop, while the notching cutter *D* cuts the first notch. The feed handle is then brought back, and the indexing trip lever is brought forward to permit rotation of the chucking handle *A* so the next notch may be made. This is continued until all five notches have been cut 72 deg. apart.

The shell is next stamped with the year of manufacture, the size and style of projectile, and the initials of the manufacturer, such as 75 MM. HE. M48-1940 FA. Stamping is done on a machine having two idler rolls which support the shell while a circular stamp in the ram of the machine is brought in contact with the outside diameter. The ram is operated by a foot pedal. The circular die is power-driven and rotates the shell while the lettering is pressed into it by a set-up shown diagramtically in Fig. 14.

Next comes knurling the band seat, the tenth operation. Annular grooves have already been cut in the band seat by means of the form tool used in operation No. 7. In this operation the longitudinal grooves are cut giving a square knurled pattern. The work is done in the set-up shown in Fig. 15. The shell is placed in a revolving rest while the two knurling rollers are brought into contact with it by pneumatic control. This in turn presses the revolving shell in contact with the working knurl which does the cutting. About eight to ten revolutions of the shell, while in

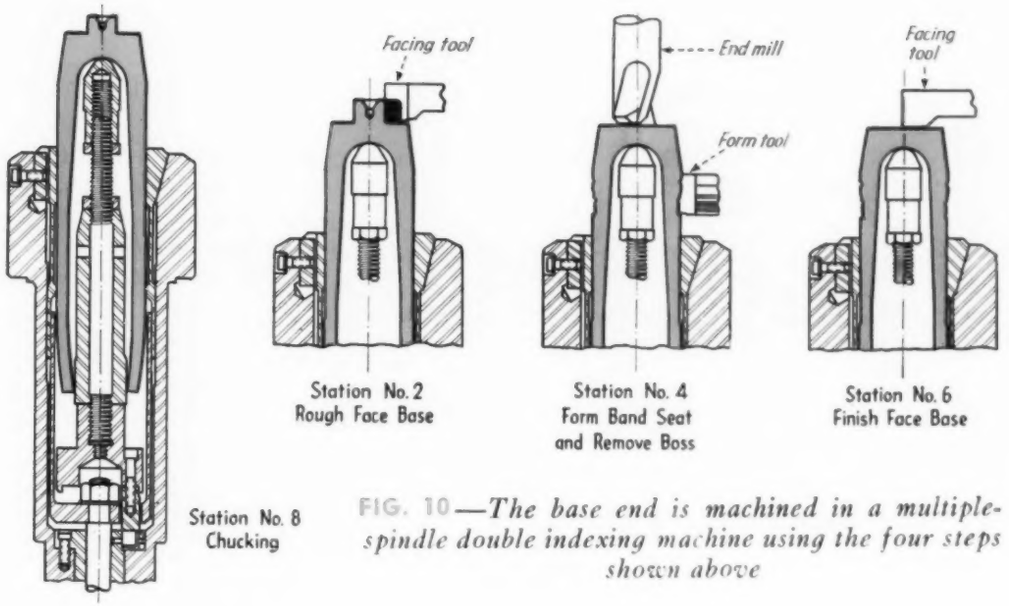


FIG. 10—*The base end is machined in a multiple-spindle double indexing machine using the four steps shown above*

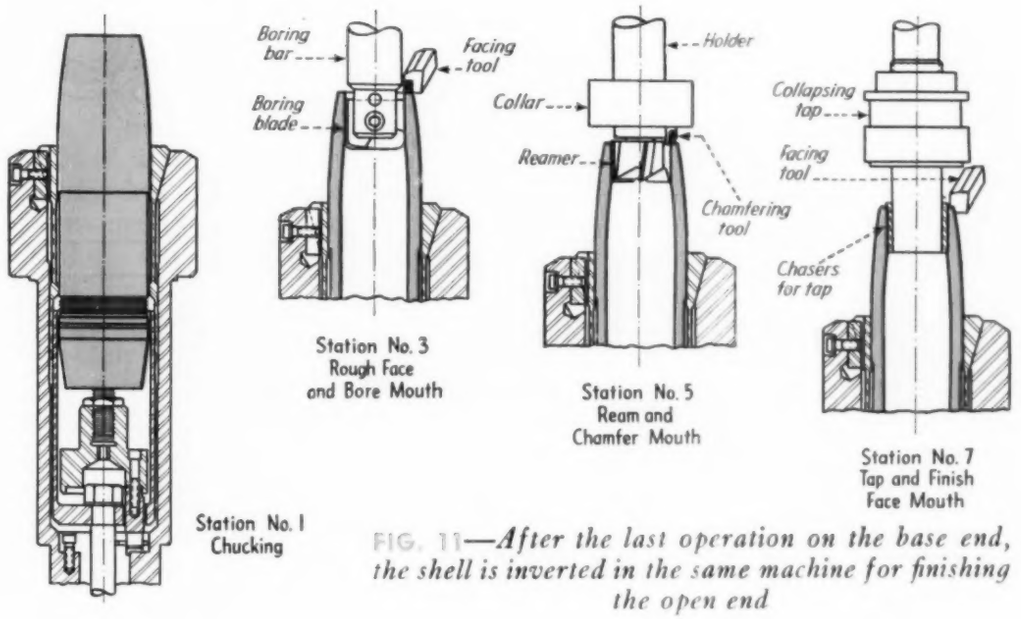


FIG. 11—*After the last operation on the base end, the shell is inverted in the same machine for finishing the open end*

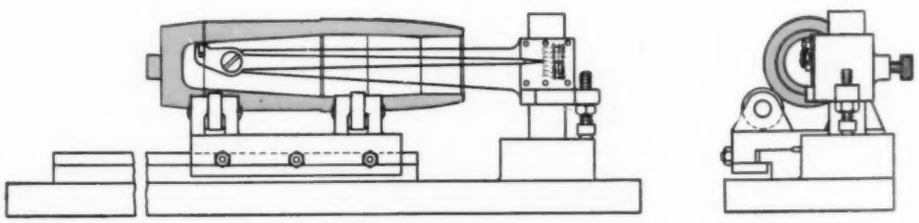


FIG. 12—*Shells are inspected in this fixture after rough and finish turning to determine the degree of runout. In this way uniform wall thickness is obtained*

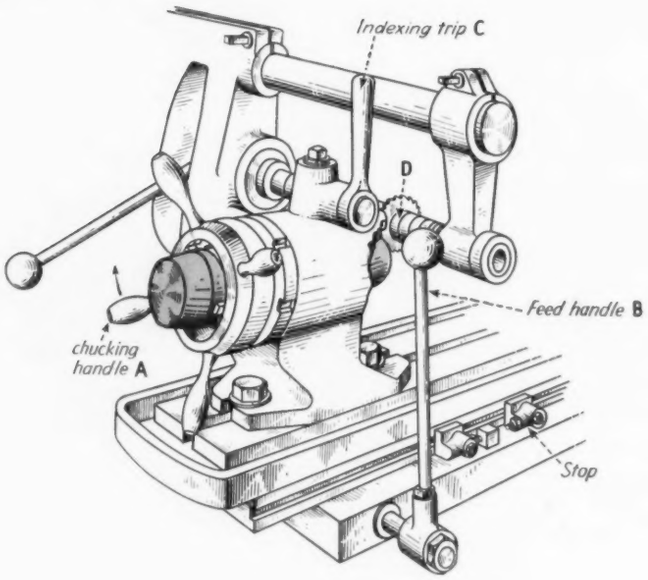


FIG. 13—*Five staking notches are cut with the shell held in this fixture on a hand-feed milling machine. The work is clamped and indexed by hand*

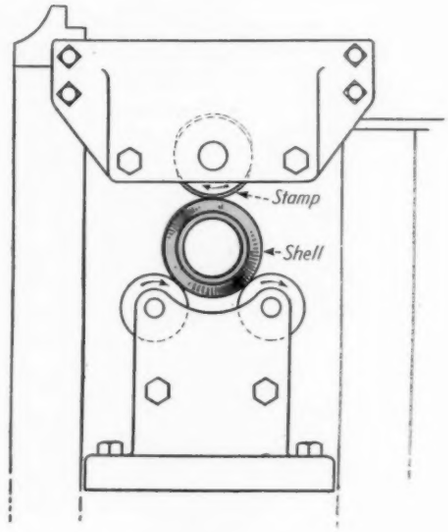


FIG. 14—*An identifying stamp is rolled on the outside of each shell just above the band seat. Pressure between the shell and revolving stamp is applied by means of a foot pedal*

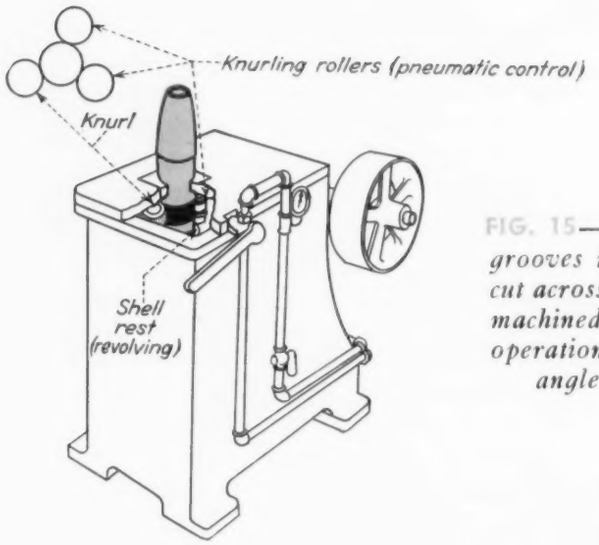


FIG. 15—*Longitudinal grooves in the band seat are cut across the annular grooves machined during the turning operation to form a right-angle knurled pattern*

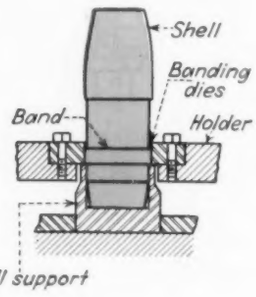


FIG. 16—*The shell is gripped in three positions in a tire setter while a pressure of 900 lbs. applies the gilding metal band to the knurled seat*

contact with the knurling tool, is required for this operation.

Operation No. 11, shown in Fig. 16, consists of pressing the rotating band into place. The gilding metal band is slipped over the shell and located at the band seat. Shell and band are then placed in a hydraulic press equipped with six dies to press the band into place. The dies are applied until a gage pressure of 900 lb. is reached, which is held approximately 3.2 sec.; the pressure is then released to permit the dies to return to neutral position. The shell is then rotated about 15 deg., and the same pressure is applied for the same amount of time. This procedure is followed three times to insure that the gilding metal band has completely filled the band seat. Periodically a band is removed for visual inspection to make certain that the metal is flowing correctly.

The twelfth operation is that of turning the band. This is done by placing the shell in a collet held in the hollow spindle of a lathe, locating from the outside base by means of a swinging stop. The carriage holding the carbide turning tool then rough turns the band which is followed by the finish turning tool. A form tool in the cross-slide puts the grooves in the band and trims it to width. A semi-automatic machine is used in this operation as shown in Fig. 17.

The thirteenth operation is welding the base cover. This consists merely of a bright soft annealed circular disk of sheet steel, SAE 1015 and No. 22 U.S. gage. It is designed to reinforce the base of the shell against the force of the explosion. The base cover is welded in place by either overlapped spot-welding or seam welding. Fig. 18 shows the seam welding set-up with two fixtures, one of which is loaded, while the other is in working position. Two welding wheels make it necessary to turn the work through only 180 deg. in order to obtain a finished continuous weld.

The last step is washing the shell to remove all oil and grease, and to prepare a surface so that paint will adhere without peeling. Dimensions on the outside diameter are checked at seven points simultaneously by means of an Electrolimit gage. The threaded fuze seat is inspected by means of a plug gage mounted on a rebuilt tapping attachment which drives the plug by friction and reverses the direction of rotation as the work is pushed on and off. All other important dimensions are checked by individual gages. This inspection is performed 100 per cent on all shells.

Following inspection, the setscrew is screwed into position, and the threads are greased. Then both exterior and interior surfaces are painted in spray booths to prevent rusting. Six shell are placed in a carton for shipment.

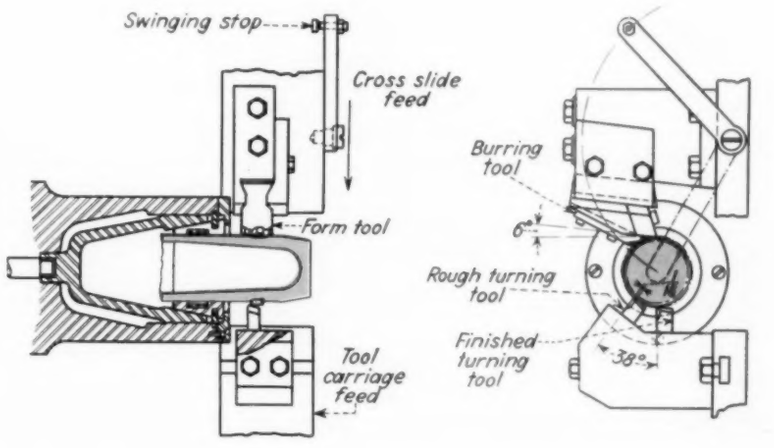


FIG. 17—*After being pressed into place, the band is rough and finish turned and trimmed in a hollow-spindle semi-automatic lathe*

It is possible to use machines made by a number of different manufacturers for each of the steps outlined above. At present the Frankford Arsenal is employing the machines given in the following tabulation. It should be remembered, however, that these are not the only methods that can be employed for the work of producing 75-mm. shell. One alternative is to use lower production general-purpose machines as was done to a large extent during the last World War.

Developments in shell manufacture have not reached an end. The Ordnance Department is continuing experiments with materials and methods that may cause important changes in the future. However, the operations described here represent the best practice that has been devised to date.

The views expressed in this article are those of the author and in no way reflect the attitude of the War Department. Statements made and figures quoted are not from official sources.

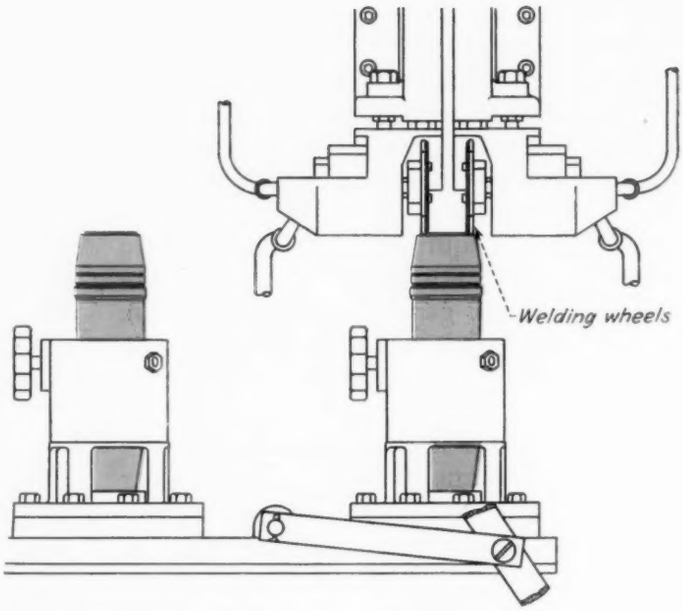


FIG. 18—*The base cover is welded in place by a seam welder using two holding fixtures. Overlapping spot welds are also acceptable*

75 MM. 1148 H.E. SHELL

BASED ON PRODUCTION OF 3,000 SHELL PER EIGHT-HOUR DAY

FINISHED FORGED CAVITY

Operation Number	Operation	Machine	Production per Machine (8 hr.)	Machines Required	Operators Required
1	Shotblast	Pangborn	1000	3.00	3.00
2	Center	Foster	1000	3.00	3.00
3	Cut-off, rough turn and face base	Fay Automatic	360	8.33	8.33
4	Cold Nose	Bliss No. 87 Crank Press	1300	2.31	2.31
5	Finish turn	Ex-Cell-O	535	5.61	5.61
6	Drill and tap set screw hole	Bodine	3000	1.00	1.00
7	Finish both ends and band seat	New Britain	600	5.00	5.00
8	Notch	Producto-Matic	1650	1.82	1.82
9	Stamp	Noble & Westbrook	3300	0.91	0.91
10	Knurl	Morley	3300	0.91	0.91
11	Apply band	West Tire Setter	1000	3.00	3.00
12	Turn band	Sundstrand	1000	3.00	3.00
13	Weld base cover	Thomson-Gibb Seam Welder	1000	3.00	3.00
		Total	....	40.89	40.89

Tap Standards

THE AMERICAN STANDARDS ASSOCIATION has approved a standard for cut and ground thread taps. It includes a standard table for markings, thread and general dimensions, and working tolerances for hand taps, machine screw taps, taper taps, nut taps, pulley taps, boiler taps, mud- or washout-hole taps, staybolt taps, pipe taps, and combined pipe tap and drill.

The form of thread profile specified is known as the "American National Form." The basic angle of thread between the sides of thread measured in an axial plane is 60 deg. The line bisecting the 60-deg. angle is perpendicular to the axis of the screw thread. The basic depth h of the thread form is found as follows:

$$h = 0.649519p = 0.649519/n$$

The basic pitch diameter is the number obtained by subtracting the single thread depth from the basic major diameter, i.e.

Basic pitch diameter = D − h

where D = major diameter, h = depth of thread, n = number of threads, and p = pitch of thread.

Tap markings include the nominal size, number of threads per inch, and the proper symbol to identify the thread form,* which symbols are:

NC—American standard coarse thread series.

NF—American standard fine thread series.

N—American standard 8-pitch, 12-pitch and 16-pitch series.

NS—Special threads with the American national form.

NH—American national hose coupling threads.

NPT—American standard taper pipe threads.

NPS—American standard straight pipe threads.

NPSG—A standardized undersize straight pipe thread for grease cup fittings.

V—A 60-deg. V-thread usually with both the crest and root flatted several thousandths from the theoretical to users specifications.

Acme—American standard 29-deg. acme-type thread.

* Such markings as U.S.S., U.S.F., S.A.E., and A.S.M.E. are now obsolete.

The American standard coarse thread series includes the following sizes and pitches:

No.	1–64 NC	$\frac{3}{8}$"–16 NC	$1\frac{1}{2}$"– 6 NC
No.	2–56 NC	$\frac{7}{16}$"–14 NC	$1\frac{3}{4}$"– 5 NC
No.	3–48 NC	$\frac{1}{2}$"–13 NC	2 "–$4\frac{1}{2}$ NC
No.	4–40 NC	$\frac{9}{16}$"–12 NC	$2\frac{1}{4}$"–$4\frac{1}{2}$ NC
No.	5–40 NC	$\frac{5}{8}$"–11 NC	$2\frac{1}{2}$"– 4 NC
No.	6–32 NC	$\frac{3}{4}$"–10 NC	$2\frac{3}{4}$"– 4 NC
No.	8–32 NC	$\frac{7}{8}$"– 9 NC	3 "– 4 NC
No.	10–24 NC	1 "– 8 NC	$3\frac{1}{4}$"– 4 NC
No.	12–24 NC	$1\frac{1}{8}$"– 7 NC	$3\frac{1}{2}$"– 4 NC
	$\frac{1}{4}$"–20 NC	$1\frac{1}{4}$"– 7 NC	$3\frac{3}{4}$"– 4 NC
	$\frac{5}{16}$"–18 NC	$1\frac{3}{8}$"– 6 NC	4 "– 4 NC

The American standard fine thread series include:

No.	0–80 NF	No. 10–32 NF	$\frac{5}{8}$"–18 NF
No.	1–72 NF	No. 12–28 NF	$\frac{3}{4}$"–16 NF
No.	2–64 NF	$\frac{1}{4}$"–28 NF	$\frac{7}{8}$"–14 NF
No.	3–56 NF	$\frac{5}{16}$"–24 NF	1 "–14 NF
No.	4–48 NF	$\frac{3}{8}$"–24 NF	$1\frac{1}{8}$"–12 NF
No.	5–44 NF	$\frac{7}{16}$"–20 NF	$1\frac{1}{4}$"–12 NF
No.	6–40 NF	$\frac{1}{2}$"–20 NF	$1\frac{3}{8}$"–12 NF
No.	8–36 NF	$\frac{9}{16}$"–18 NF	$1\frac{1}{2}$"–12 NF

In addition to the regular marking, bent-shank tapper taps with cut threads are marked "Class 2" while those with precision commercial ground threads are marked "Class 3."

Special taps (except ground thread taps marked with limit numbers stipulated later) varying only slightly from standard dimensions are marked with the letter S in a circle.

Taps varying on the pitch diameter up to 0.015 in. over or under basic are marked with the actual amount the low limit is over or under the basic size, and standard size.

Fractional size taps with commercial ground threads and machine screw taps with either commercial or precision ground threads are marked with one ring on the shank near the thread in addition to the standard marking.

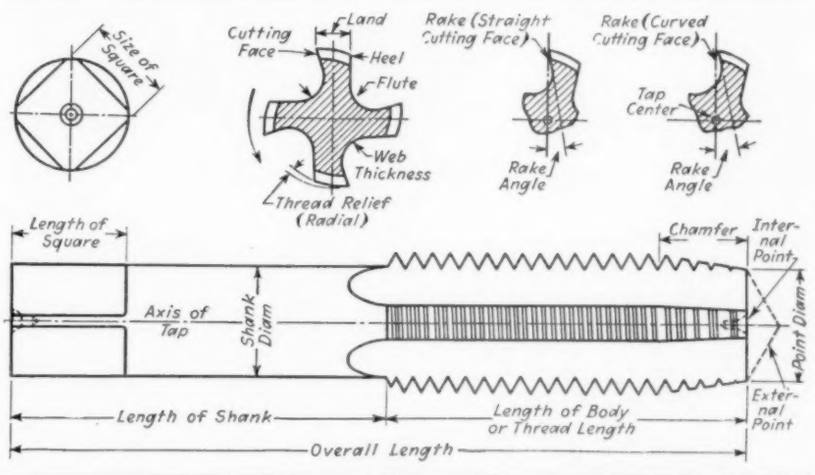
Precision ground thread taps having a pitch diameter between basic and minus 0.0005 are marked with "01." Those having a pitch diameter between basic and plus 0.0005 are marked with "1." Those with a pitch diameter between 0.0005 to 0.0010 over basic are marked "2."

Ground thread pipe taps are marked "CG" if the pitch-diameter grinding tolerance is equal to or greater than the following values (they are marked "PG" if it is less):

4 to $5\frac{1}{2}$ threads per in. incl.	0.0020 in.
6 threads per in.	0.0018 in.
7 threads per in.	0.0015 in.
8 threads per in.	0.0014 in.
9 threads per in.	0.0014 in.
10 and $11\frac{1}{2}$ threads per in.	0.0011 in.
12 threads per in. and finer	0.0010 in.

Taps and dies having multiple threads are marked with (1) diameter, (2) number of threads to the inch, (3) form of thread, (4) lead designated in fractions, and (5) double, triple or quadruple. For example a 1-in., 16 double-thread special tap is marked:

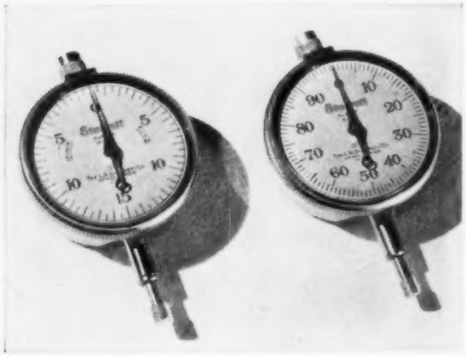
1"—16NS
$\frac{1}{8}$ Lead Double



Tap terms adopted as standard by the American Standards Association

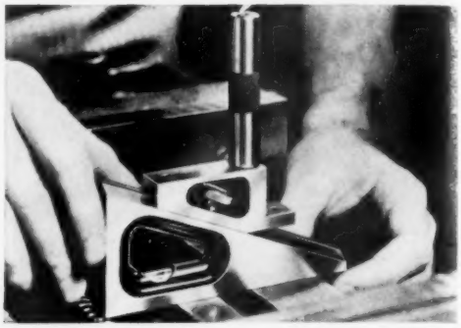
STARRETT TOOLS

WHO SAYS YOU CAN'T RUSH PRECISION WORK?



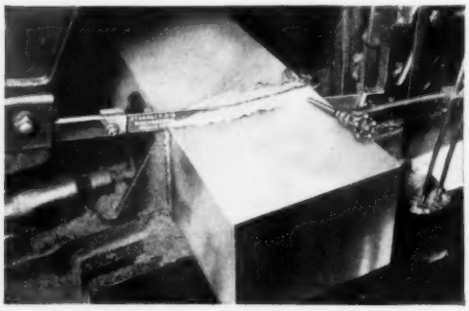
YES or NO... NOT MAYBE when you check with Starrett Indicators

The wide choice of models, types and dial calibrations available lets you pick the right Starrett Dial Indicator for any production measuring, testing or comparing operation. Fast, sensitive actions; big, easy-reading dials insure speed with accuracy. Also a large selection of LAST WORD Indicator models.



Save PLANER and SHAPER Time with this STARRETT Precision Gage

Make every first cut "on the nose" by setting planer or shaper tools with a Starrett No. 599 Shaper Gage. Used with a micrometer or caliper, it will gage with accuracy within its range of ¼ to 6½ inches. Alignment and parallelism of ends, sides and work contacts held to close limits. Use of angular slide ways eliminates lateral play. Note handy level.



Get After Metal Cutting with the RIGHT Starrett Hacksaw

Misfit hacksaw blades waste valuable time — tie up useful men and machines. End this loss the simple, effective way — select the correct hacksaw blades for your kind of metal cutting from the complete Starrett line. Your choice of Tungsten Alloy, High Speed Steel or S-M Molybdenum in all standard machine or hand frame sizes.

Don't Make Special Tools Before Checking STARRETT CATALOG

Time and expense required to make special tools can often be saved by using the standard blocks, clamps, gages and other tools shown in Starrett Catalog No. 26-C. Write for a free copy and look them over.

THE L. S. STARRETT CO.
ATHOL · MASSACHUSETTS · U·S·A·

AVAILABLE THROUGH ALL LEADING SUPPLY HOUSES

Tap Standards

AMERICAN NATIONAL FORM THREAD LIMITS

Fractional Size Taps—Cut Thread

Size	Threads per Inch			Major Diameter			Pitch Diameter		
	NC	NF	NS	Basic	Min	Max	Basic	Min	Max
1/16	..	..	64	0.0625	0.0635	0.0650	0.0524	0.0526	0.0536
3/32	..	..	48	0.0938	0.0951	0.0966	0.0803	0.0805	0.0815
1/8	..	..	40	0.1250	0.1266	0.1286	0.1088	0.1090	0.1105
5/32	..	..	32	0.1563	0.1585	0.1605	0.1360	0.1365	0.1380
5/32	..	..	36	0.1563	0.1580	0.1600	0.1382	0.1384	0.1399
3/16	..	..	24	0.1875	0.1903	0.1923	0.1604	0.1609	0.1624
3/16	..	..	32	0.1875	0.1897	0.1917	0.1672	0.1677	0.1692
7/32	..	..	24	0.2188	0.2216	0.2236	0.1917	0.1922	0.1937
7/32	..	..	32	0.2188	0.2210	0.2230	0.1986	0.1990	0.2005
1/4	20	..	..	0.2500	0.2532	0.2557	0.2175	0.2180	0.2200
1/4	..	..	24	0.2500	0.2528	0.2553	0.2229	0.2234	0.2254
1/4	..	..	27	0.2500	0.2525	0.2550	0.2259	0.2264	0.2284
1/4	..	28	..	0.2500	0.2524	0.2549	0.2268	0.2273	0.2288
1/4	..	..	32	0.2500	0.2522	0.2547	0.2297	0.2302	0.2317
5/16	18	..	..	0.3125	0.3160	0.3185	0.2764	0.2769	0.2789
5/16	..	..	20	0.3125	0.3157	0.3182	0.2800	0.2805	0.2825
5/16	..	24	..	0.3125	0.3153	0.3178	0.2854	0.2859	0.2874
5/16	..	..	27	0.3125	0.3150	0.3175	0.2884	0.2889	0.2904
5/16	..	..	32	0.3125	0.3147	0.3172	0.2922	0.2927	0.2942
3/8	16	..	..	0.3750	0.3789	0.3814	0.3344	0.3349	0.3369
3/8	..	..	20	0.3750	0.3782	0.3807	0.3425	0.3430	0.3450
3/8	..	24	..	0.3750	0.3778	0.3803	0.3479	0.3484	0.3499
3/8	..	..	27	0.3750	0.3775	0.3800	0.3509	0.3514	0.3529
7/16	14	..	..	0.4375	0.4419	0.4449	0.3911	0.3916	0.3941
7/16	..	20	..	0.4375	0.4407	0.4437	0.4050	0.4055	0.4075
7/16	..	..	24	0.4375	0.4403	0.4433	0.4104	0.4109	0.4129
7/16	..	..	27	0.4375	0.4400	0.4430	0.4134	0.4139	0.4159
1/2	..	..	12	0.5000	0.5050	0.5080	0.4459	0.4464	0.4489
1/2	13	..	..	0.5000	0.5047	0.5077	0.4500	0.4505	0.4530
1/2	..	20	..	0.5000	0.5032	0.5062	0.4675	0.4680	0.4700
1/2	..	..	24	0.5000	0.5028	0.5058	0.4729	0.4734	0.4754
1/2	..	..	27	0.5000	0.5025	0.5055	0.4759	0.4764	0.4784
9/16	12	..	..	0.5625	0.5675	0.5705	0.5084	0.5089	0.5114
9/16	..	18	..	0.5625	0.5660	0.5690	0.5264	0.5269	0.5289
9/16	..	..	27	0.5625	0.5650	0.5680	0.5384	0.5389	0.5409
5/8	11	..	..	0.6250	0.6304	0.6334	0.5660	0.5665	0.5690
5/8	..	..	12	0.6250	0.6300	0.6330	0.5709	0.5714	0.5739
5/8	..	18	..	0.6250	0.6285	0.6315	0.5889	0.5894	0.5914
5/8	..	..	27	0.6250	0.6275	0.6305	0.6009	0.6014	0.6034
11/16	..	..	11	0.6875	0.6929	0.6969	0.6285	0.6290	0.6320
11/16	..	..	16	0.6875	0.6914	0.6954	0.6469	0.6474	0.6499
3/4	10	..	..	0.7500	0.7559	0.7599	0.6850	0.6855	0.6885
3/4	..	..	12	0.7500	0.7550	0.7590	0.6959	0.6964	0.6994
3/4	..	16	..	0.7500	0.7539	0.7579	0.7094	0.7099	0.7124
3/4	..	..	27	0.7500	0.7525	0.7565	0.7259	0.7264	0.7289
7/8	9	..	..	0.8750	0.8820	0.8860	0.8028	0.8038	0.8068
7/8	..	..	12	0.8750	0.8805	0.8845	0.8209	0.8219	0.8249
7/8	..	14	..	0.8750	0.8799	0.8839	0.8286	0.8296	0.8321
7/8	..	..	27	0.8750	0.8780	0.8820	0.8509	0.8519	0.8544
1	8	..	..	1.0000	1.0078	1.0118	0.9188	0.9198	0.9228
1	..	..	12	1.0000	1.0055	1.0095	0.9459	0.9469	0.9499
1	..	14	..	1.0000	1.0049	1.0089	0.9536	0.9546	0.9571
1	..	..	27	1.0000	1.0030	1.0070	0.9759	0.9769	0.9794
1 1/8	7	..	..	1.1250	1.1337	1.1382	1.0322	1.0332	1.0367
1 1/8	..	12	..	1.1250	1.1305	1.1350	1.0709	1.0719	1.0749
1 1/4	7	..	..	1.2500	1.2587	1.2632	1.1572	1.1582	1.1617
1 1/4	..	12	..	1.2500	1.2555	1.2600	1.1959	1.1969	1.1999
1 3/8	6	..	..	1.3750	1.3850	1.3895	1.2667	1.2677	1.2712
1 3/8	..	12	..	1.3750	1.3805	1.3850	1.3209	1.3219	1.3249
1 1/2	6	..	..	1.5000	1.5100	1.5145	1.3917	1.3927	1.3962
1 1/2	..	12	..	1.5000	1.5055	1.5100	1.4459	1.4469	1.4499
1 5/8	..	..	5 1/2	1.6250	1.6344	1.6399	1.5069	1.5084	1.5124
1 3/4	5	..	..	1.7500	1.7602	1.7657	1.6201	1.6216	1.6256
1 7/8	..	..	5	1.8750	1.8852	1.8907	1.7451	1.7466	1.7506
2	4 1/2	..	..	2.0000	2.0111	2.0166	1.8557	1.8572	1.8612

All dimensions are given in inches.

LEAD TOLERANCE. A maximum lead error of plus or minus 0.003 in. in one inch of thread is permitted.

ANGLE TOLERANCE.

Threads per Inch	Error in Half Angle	Error in Full Angle
4 1/2 to 5 1/2 incl.	35 min plus or minus	53 min
6 to 9 incl.	40 min plus or minus	60 min
10 to 28 incl.	45 min plus or minus	68 min
30 to 64 incl.	60 min plus or minus	90 min

Fractional Size Taps—Commercial Ground Thread

Size	Threads per Inch			Major Diameter			Pitch Diameter		
	NC	NF	NS	Basic	Min	Max	Basic	Min	Max
1/4	20	..	..	0.2500	0.2540	0.2550	0.2175	0.2180	0.2190
1/4	..	28	..	0.2500	0.2525	0.2535	0.2268	0.2273	0.2283
5/16	18	..	..	0.3125	0.3170	0.3180	0.2764	0.2769	0.2779
5/16	..	24	..	0.3125	0.3155	0.3165	0.2854	0.2859	0.2869
3/8	16	..	..	0.3750	0.3800	0.3810	0.3344	0.3349	0.3359
3/8	..	24	..	0.3750	0.3780	0.3790	0.3479	0.3484	0.3494
7/16	14	..	..	0.4375	0.4435	0.4445	0.3911	0.3916	0.3926
7/16	..	20	..	0.4375	0.4415	0.4425	0.4050	0.4055	0.4065
1/2	13	..	..	0.5000	0.5065	0.5075	0.4500	0.4505	0.4515
1/2	..	20	..	0.5000	0.5040	0.5050	0.4675	0.4680	0.4690
9/16	12	..	..	0.5625	0.5690	0.5700	0.5084	0.5089	0.5099
9/16	..	18	..	0.5625	0.5670	0.5680	0.5264	0.5269	0.5279
5/8	11	..	..	0.6250	0.6320	0.6330	0.5660	0.5665	0.5676
5/8	..	18	..	0.6250	0.6295	0.6305	0.5889	0.5894	0.5904
11/16	..	..	11	0.6875	0.6945	0.6955	0.6285	0.6290	0.6301
11/16	..	..	16	0.6875	0.6925	0.6935	0.6469	0.6474	0.6484
3/4	10	..	..	0.7500	0.7575	0.7590	0.6850	0.6855	0.6866
3/4	..	16	..	0.7500	0.7550	0.7560	0.7094	0.7099	0.7109
7/8	9	..	..	0.8750	0.8835	0.8850	0.8028	0.8038	0.8050
7/8	..	14	..	0.8750	0.8810	0.8820	0.8286	0.8296	0.8306
1	8	..	..	1.0000	1.0095	1.0110	0.9188	0.9198	0.9212
1	..	14	..	1.0000	1.0060	1.0070	0.9536	0.9546	0.9556
1 1/8	7	..	..	1.1250	1.1350	1.1370	1.0322	1.0332	1.0347
1 1/8	..	12	..	1.1250	1.1315	1.1325	1.0709	1.0719	1.0729
1 1/4	7	..	..	1.2500	1.2600	1.2620	1.1572	1.1582	1.1597
1 1/4	..	12	..	1.2500	1.2565	1.2575	1.1959	1.1969	1.1979
1 3/8	6	..	..	1.3750	1.3870	1.3890	1.2667	1.2677	1.2695
1 3/8	..	12	..	1.3750	1.3815	1.3825	1.3209	1.3219	1.3229
1 1/2	6	..	..	1.5000	1.5120	1.5140	1.3917	1.3927	1.3945
1 1/2	..	12	..	1.5000	1.5065	1.5075	1.4459	1.4469	1.4479

LEAD TOLERANCE. A maximum lead error of plus or minus 0.0005 in. in one inch of thread is permitted.

ANGLE TOLERANCE.

Threads per Inch	Error in Half Angle
6 to 9 incl.	25 min plus or minus
10 to 28 incl.	30 min plus or minus

Fractional Size Taps—Precision Ground Thread

Size	Threads per Inch		Major Diameter		Basic Pitch Diameter	Pitch Diameter Limits			
						1 Limit			
						01 Limit		2 Limit	
	NC	NF	Min	Max		Min 01	Max 01 Min 1	Max 1 Min 2	Max 2
1/4	20	..	0.2540	0.2550	0.2175	0.2170	0.2175	0.2180	0.2185
1/4	..	28	0.2525	0.2535	0.2268	....	0.2268	0.2273	0.2278
5/16	18	..	0.3170	0.3180	0.2764	0.2759	0.2764	0.2769	0.2774
5/16	..	24	0.3155	0.3165	0.2854	....	0.2854	0.2859	0.2864
3/8	16	..	0.3800	0.3810	0.3344	0.3339	0.3344	0.3349	0.3354
3/8	..	24	0.3780	0.3790	0.3479	....	0.3479	0.3484	0.3489
7/16	14	..	0.4435	0.4445	0.3911	0.3906	0.3911	0.3916	0.3921
7/16	..	20	0.4415	0.4425	0.4050	....	0.4050	0.4055	0.4060
1/2	13	..	0.5065	0.5075	0.4500	0.4495	0.4500	0.4505	0.4510
1/2	..	20	0.5040	0.5050	0.4675	....	0.4675	0.4680	0.4685
9/16	12	..	0.5690	0.5700	0.5084	....	0.5084	0.5089	0.5094
9/16	..	18	0.5670	0.5680	0.5264	....	0.5264	0.5269	0.5274
5/8	11	..	0.6320	0.6330	0.5660	....	0.5660	0.5665	0.5670
5/8	..	18	0.6295	0.6305	0.5889	....	0.5889	0.5894	0.5899
3/4	10	..	0.7575	0.7590	0.6850	....	0.6850	0.6855	0.6860
3/4	..	16	0.7550	0.7560	0.7094	....	0.7094	0.7099	0.7104
7/8	9	..	0.8835	0.8850	0.8028	....	0.8028	0.8033	0.8038
7/8	..	14	0.8810	0.8820	0.8286	....	0.8286	0.8291	0.8296
1	8	..	1.0095	1.0110	0.9188	....	0.9188	0.9193	0.9198
1	..	14	1.0060	1.0070	0.9536	....	0.9536	0.9541	0.9546

LEAD TOLERANCE. A maximum lead error of plus or minus 0.0005 in. in one inch of thread is permitted.

ANGLE TOLERANCE.

Threads per Inch	Error in Half Angle
8 to 9 incl.	25 min plus or minus
10 to 28 incl.	30 min plus or minus

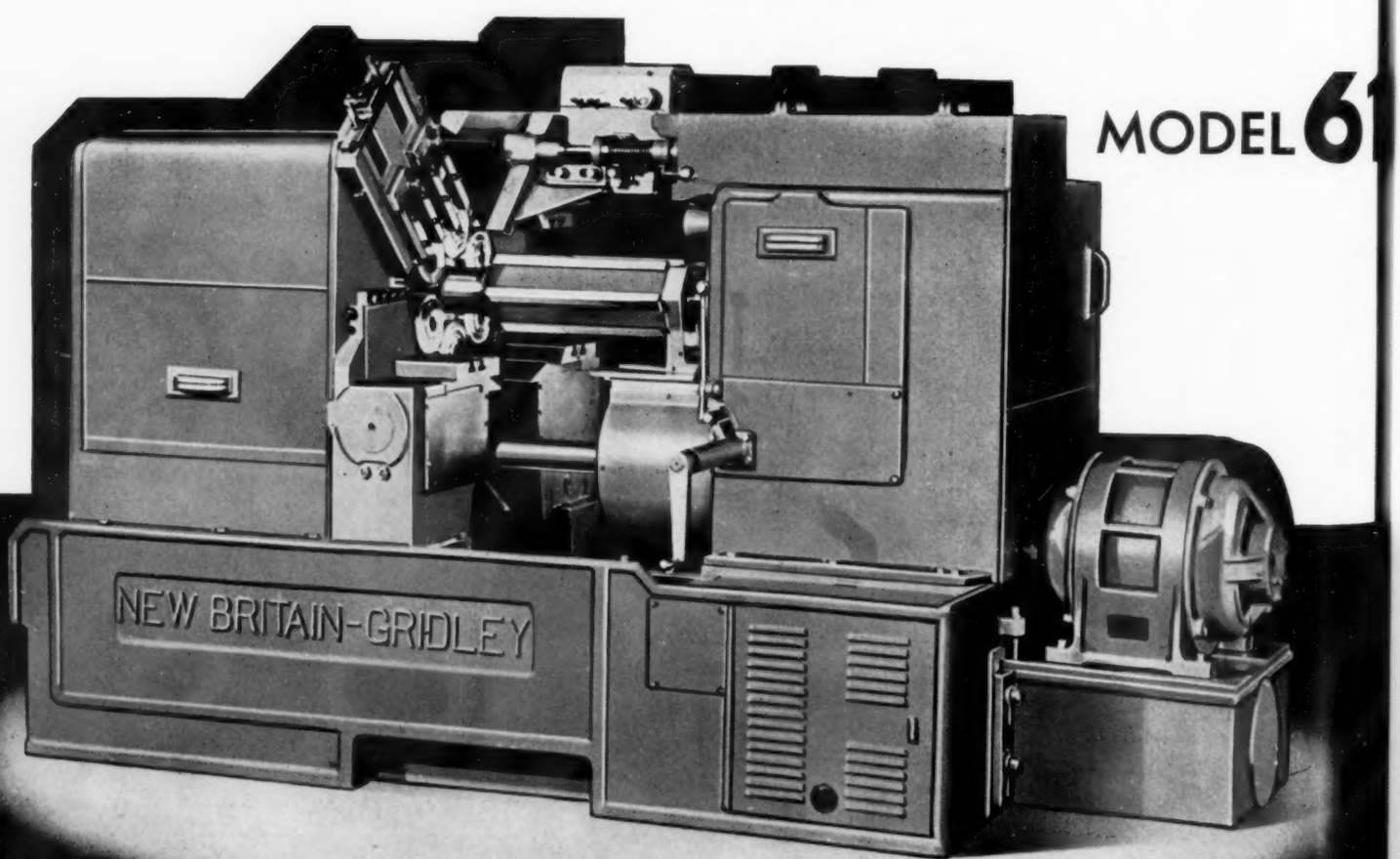
FOR THE DEFENSE PROGRAM

A complete line of 6 Spindle Automatic Screw Machines for the production of:

FUSE BODIES AND COMPONENTS
BULLET CORES
SMALL PROJECTILES
AND
OTHER RELATED PARTS

NEW BRITAIN-GRIDLEY

MACHINE DIVISION • THE NEW BRITAIN MACHINE CO.
NEW BRITAIN, CONNECTICUT



MODEL 61

A complete line of Screw Machines — Four and Six Spindles to 2¼" Capacity
Also a complete line of Chuckers — Four, Six and Eight Spindles to 10⅜" Capacity

Set the Public Straight

A DELIBERATE campaign against industry in connection with the defense program is going on. It is hard to prove that it is a concerted drive to poison the public's mind against industry. Yet the effect will be that unless something is done to offset it.

The excuse for the campaign is the refusal of most manufacturers to sign armament contracts unless they can write off new plant investments in five years or less. Such refusals, it is charged, have seriously delayed production of planes, tanks and other vital materials.

An example of the attacks on industry is the Department of Justice's action in asking the Supreme Court to take up a case in which the government seeks modification of wartime contracts made with Bethlehem Shipbuilding in 1917 and 1918. The department links this action to the present situation by declaring that "in times of national emergency the men charged with preparing the nation's defenses have no time to haggle with a contractor who refuses to perform his indispensable functions unless he be assured an exorbitant profit."

This sort of tactics by the Justice Department seems unwarranted. It is like dragging a skeleton out of the closet. You might as well go back and assail some of the practices of Standard Oil before the dissolution decree of 1911. The cost-plus type of contract which Bethlehem Shipbuilding had in 1917 isn't even being considered today. An excess profits tax soon to be enacted by Congress, not to mention limitation of profits, will effectively prevent exorbitant profit-making. What industry wants is assurance that it will get back the money it puts into defense ventures, clear aside from any possible profits. Yet publicity released by the Justice Department regarding this ancient case implies that the government must be saved from being the prey of industry.

What can be done to convince the public that industry is seeking merely fair and equitable treatment? What can be done to make it clear to the public that it won't be industry's fault if huge quantities of planes and of munitions aren't being turned out in the next few months?

At least two ways appear open. One is for industrialists to agree to proceed with necessary plant construction and tooling without waiting for the exact terms to be worked out. Some plane makers have chosen that course, which puts the responsibility for a square deal on Washington. But surely industry can be pardoned if it shivers and shows signs of running a temperature when it contemplates what Washington may consider a fair deal. Will it be Jesse Jones' definition or Harry Hopkins'?

The other course of action is for every manufacturer involved in defense plans to make frank reports to all employees and to his community on his contractual relations with the government. He should not hesitate to report the terms, why he has rejected any objectionable contract, what the contract means to his employees and to the community in increased payrolls and more employment while the defense effort is being furthered.

No piece of public relations is half so vital to industry at this time as telling the people frankly and fully its part in arming the nation and in explaining how much or how little it stands to profit financially. A big educational job confronts industry.

Burnham Finney

GAGING BUSINESS

Release of aircraft orders means new plant expansion. Pratt & Whitney's award for 17,000 engines tops list. Buying of railroad equipment improves. Large munitions orders to break

Business is definitely entering the boom period of defense—boom in the sense of employment, and expansion of plant and output, rather than profits. For between profits limitation, excess profits taxes and compulsory contracts most business men are resigned to modest earnings. Even so they resent the inference that they are not as patriotic as the citizens who say it with words but not with dollars; and they see no excuse for the plant seizure clause in the Senate draft bill.

Machine Tools—Domestic demand now far overshadows the foreign buying that loomed so large earlier in the year. Defense needs, direct and indirect, form the biggest single factor with more heavy buying in the offing as new armament plans get under way. Despite a high level of activity, August orders proved spotty; some sections of the country report sales at a peak, while others found the month far below the year's average. Deliveries are still a problem, but buyers are getting used to them and are learning to anticipate their needs. Inquiries are extremely active, pointing to the prospect of continued good demand throughout the balance of 1940. Chrysler, Packard, Ford and General Motors are all planning new facilities for aircraft and armament manufacture. Within a month some large orders should be placed for this purpose. Canadian business is good.

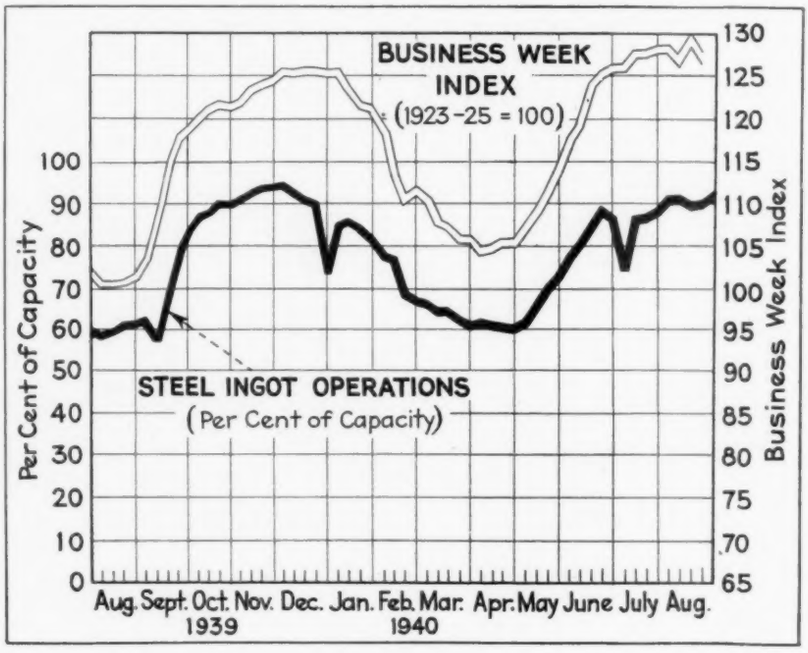
Railroad Equipment — With the Chicago, Rock Island, Pacific announcement of 800 cars ordered from Pressed Steel Car Co., freight car purchases for the first eight months of the year now exceed 20,000 cars, well ahead of last year at this time. Fifty-nine passenger cars ordered in August exceed the 51 placed in the first seven months of the year. Sixty-one locomotives ordered in August brings the year's total near the 300 mark. Other activity includes modernization of 1,000 cars in its own shops by Chicago and Northwestern Railroad and rebuilding of 400 cars by Chicago, Rock Island & Pacific.

Steel—The steel situation appears to be safe against shortage for at least the next two months, civil operations are slackening and heavy users have accumulated comfortable stocks against forthcoming heavy demands. The Navy has taken bids on 180,000 tons for strictly maintenance uses. Materials supervision will safeguard against overstocking by both defense contractors and civil users.

Aircraft—Such is the magnitude of recent aircraft orders that political bickering as to whether or not the air program has bogged down can now be shelved. Pratt & Whitney has received one of the largest orders on record — $160,000,000 for 17,000 radial engines. Plant expansion to handle this volume is to be financed by the company while machine tool equipment will be bought and title held by the government—a unique method of cooperation. The Army has placed a $14,861,342 order for Consolidated bombers while North American Aviation is to supply planes to the value of $11,335,631. Orders for army training planes have been received by Beech Aircraft ($3,410,746), Stearman Aircraft ($2,041,947), and Fairchild ($1,038,300). A $1,090,894 engine order has been placed with Continental Motors. New announcements of additional expansions are popping every day.

Munitions—Less than a third of appropriations to date ($6,600,000,000) have been placed under contract and much of this is Navy work extending to 1942-3-4. Once the amortization and tax bills pass, contracts for large amounts will be awarded within 60 days. Heavy defense buying is certain to involve new plant construction as well as purchase of materials and equipment. Since Army needs are for short-term production, the Army will get the lion's share of appropriations now pending. Of the first big defense outlay, the Navy got, in round figures, four billion, the Army, one billion; the pending bill almost exactly reverses these figures. Army plans for 1,800 tanks may be supplemented by British orders for 4,000; approval of the latter order is being sought in Washington. Orders for gun equipment have been placed with Miehle Printing Press ($4,100,000), Baldwin Locomotive Works ($3,134,000), Westinghouse ($10,865,200), and Blaw-Knox ($1,242,000).

Farm Equipment—The Army has been testing a high-speed adaptation of the farm tractor which is being manufactured by Minneapolis-Moline Power Implement Co. Weighing seven tons the tractor features a low center gravity, 40 miles per hour speed and 7,500 lb. drawbar pull.



Contrary Reports On Airplane Defense Program Continues Despite Recent Orders

WASHINGTON—Despite the many orders recently placed, charges continue that the defense airplane contract program has bogged down. President Roosevelt, manfully defending his Defense Commission, gave a good statistical answer to the critics at his last press conference. However, there seems to be further reasons for the delay of which the President probably would not feel free to mention.

One is that, regardless of contracts signed, the industry is building planes as fast as it can. Yes, critics say, but the industry could start its plant expansion if it had the green light. Major units (Martin, Boeing, Douglas, Curtiss-Wright, Pratt & Whitney, Packard) are already pushing expansion to the limit of their available manpower. Probably much more preparation than is indicated is being carried on by other companies, in anticipation of amortization guarantees by the Government.

The other answer for the delay is that if this country wants to help Great Britain, as the majority undoubtedly do, nearly all of the military planes we can build will have to be sold to Britain as long as she fights.

Mr. Roosevelt's answer to this was that since September the nation's capacity to produce military and training planes has increased from 6,000 to 10,000. By Jan. 1 it will be 13,000, he said. During 1941 it will reach 24,000 and in 1942 we can turn out 35,000. He said that actual contracts at this time, for War and Navy, call for 6,361. In addition, under "letters of intent", manufacturers are going ahead on 3,054 planes for the Army, and 600 for the Navy with the total being 10,015.

A maze of contradictory figures, some ridiculously small, are being quoted by critics of the Administration in Congress. However, the criticism has revealed that most of the planes we do have on order are trainers, and that the major portion of the airplane program is still sidetracked in the five-billion dollar supplemental defense bill over which the Senate is haggling.

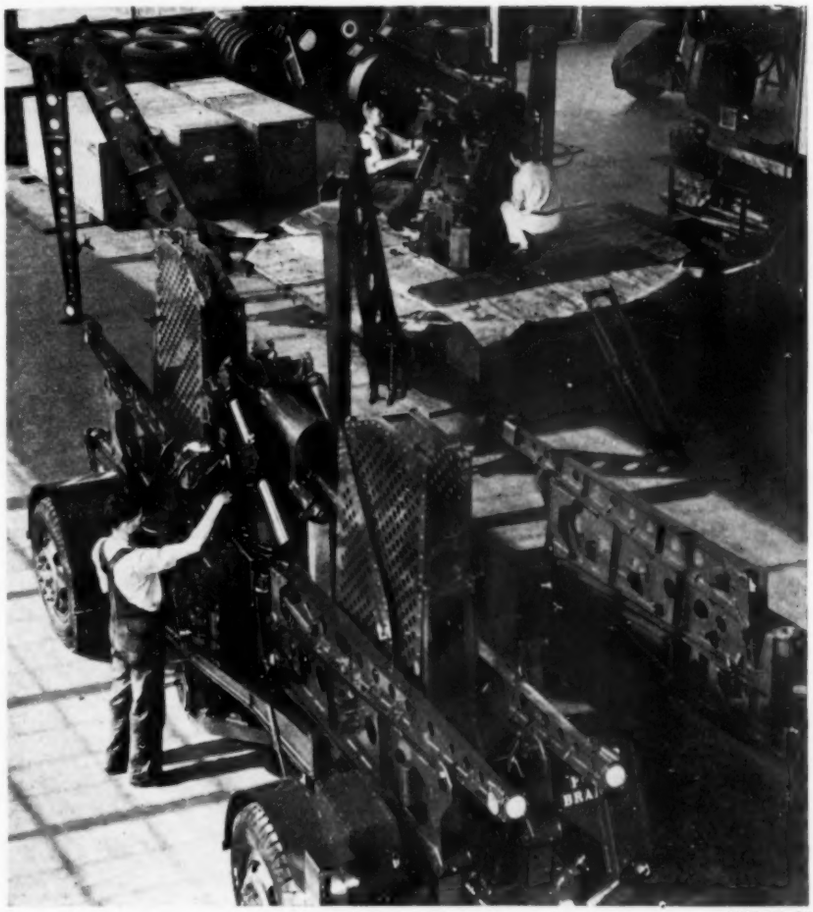
17,000 ENGINES SPEEDED

WASHINGTON—In order to save the time of manufacturers the Defense Commission has agreed with the War and Navy departments that each department should deal alone with certain companies. In this way the manufacturer's output is restricted to one customer instead of two or more. For that reason Pratt & Whitney's order of 17,000 engines to be delivered to the Bureau of Aeronautics and the Air Corps was placed by the Navy. Tooling-up will take about eight months for this job but the government is depending on the cooperation of machine tool makers in the way of priorities. Tools will cost $1,000,000. plant expansion $2,500,000. The total amount of the Navy order is $160,000,000 which makes the unit cost, $9,411.76. Engines delivered to the Army will be paid for by a transfer of funds to the Navy for that purpose.

RFC Loans Totaling $78,500,000 Go To 3 Airplane Manufacturers

WASHINGTON—Loans totaling $78,500,000 were authorized by RFC to three airplane manufacturers. The largest went to Curtiss Wright for expansion of several plants and one new plant near Lackland, Ohio, total, $51,000,000. Bendix Aviation was awarded a loan of $17,000,000 for enlargement of plants and for purchase of equipment. A commitment of $10,500,000 was made to Boeing Aircraft Company for extension of its plant at Seattle and for expansion at Wichita, Kansas, where the Stearman trainer is built. Previously, Curtiss Wright had been granted an RFC loan of $92,000,000 for expansion of many of its lines.

Meanwhile Pratt & Whitney, Vought Sikorsky, and Hamilton Standard Propeller divisions of United Aircraft were committed to spend a total of $15,000,000, privately financed. This is the third United Aircraft expansion within the year and it will increase the engine output by about 1500 per month. While Wright Aeronautical sticks pretty much to engines in the 1000 hp. class, Pratt & Whitney continue to make smaller engines for training planes.



Wide World

Hellzapoppin—*Or soon will be when these 3-inch anti-aircraft guns are placed into operation by the U.S. Army. At York, Pa., the York Safe & Lock Co. produces guns and gun carriages as an integral part of the defense program. In the foreground are outrigger supports for guns*

Chrysler Tank Plant May Cast Armor Instead of Fabricating From Rolled Plate

DETROIT—As yet contracts have not been let by the Chrysler Corp. for the government tank plant which it is building on a 113-acre tract just outside of the city. Plans for factory buildings are being drawn, but weeks of planning remain before all details of machinery and tooling can be decided. And there are rumors that the Army has a new idea for tank fabrication that may hold up some major phases of the program until it is threshed out. Briefly, a suggestion has been made that the armor section might be cast instead of fabricated from rolled plate.

The armor section is huge—measuring perhaps 9 ft. wide by 20 ft. long by 4 ft. deep and being from one to three inches thick at various sections. Casting such a structure would probably require pouring 30,000 lb. of metal. Besides, other machining and heat-treating methods would be required as compared to the fabricated design.

Just because tank armor has not been cast before is no reason to reject the idea. The war in Europe has changed concepts of tanks rapidly. At first, one-half inch armor was considered sufficient for the Chrysler program. But later on expert advice from the British started thicknesses moving upward, until two and three inches are being considered for vital sections of 25-35 ton cannon-carrying tanks.

The casting idea may be thrown out before this article is published. But the point is this: design details can and probably will be changed a number of times before the plant is ready to operate. If it actually gets going before the scheduled thirteen months allowed for construction—sometime next summer—a monumental job will have been accomplished.

Unofficial estimates place the number of tanks involved in the contract at approximately 1,000, at a cost of $34,500,000. The rate of production in the finished factory is scheduled to be four or five units per day. The factory which may be completed within 13 months will employ between 4,000 and 5,000 workers.

When the plant which will cost $20,000,000—paid for by the government—is completed the company will return it, will then lease it for $1 a year for the life of the contract. In addition the plant will be designed for immediate expansion if found necessary.

Signature of the contract was the result of two months of engineering studies and negotiations between the company and the defense commission. Besides Chrysler, the American Car & Foundry Co. is engaged in tank building, White Motor Co. is building combat cars, and Baldwin Locomotive is building heavy tanks for national defense.

Pratt & Whitney Engine May Be Produced by Ford Co. Soon

DETROIT—Details of the Ford program to build Pratt & Whitney engines were still being worked out in Washington last week. Final writing of a contract may take several months, but Ford is going ahead with plans to build a plant in the Rouge and to ascertain equipment needs. Pratt & Whitney practice will be duplicated, so the time consumed in developing an original proposition will not be required.

Ford's liquid-cooled engine has reached the point where it may be possible to start the tooling-up process within six weeks, and actually begin manufacture in a year. For the liquid-cooled job it is possible that some of the 10,000,000 sq. ft. of floorspace in the Highland Park plant will be utilized. So far nothing has been moved into that plant in recent months except upholstery and trim operations. But perhaps the Highland Park plant will not be used for airplane motors at any time. Company officials stated positively that a plant would be erected at Rouge for the Pratt & Whitney undertaking, and that no "government" plant was contemplated.

Export of Plane Products Increase 182 Percent In 6 Months

WASHINGTON—For the first six months of this year exports of aeronautics products increased over the same period in 1939 by 182 percent to a total of $138,388,046. Exports for the last half of 1939 were increased by over 100 percent, and by 17 percent over the value of shipments for the entire last year.

France and England took 68 percent of the total exports in the first six months of 1940. French purchases for that period amounted to $75,375,565, while England purchased $8,167,976.

A total of 1,532 aircraft, valued at $95,261,402, was among the aeronautic products exported in the first half of 1940. This virtually doubled the shipments in the last half of 1939. Exports of aircraft engines in the first six months of 1940 amounted to 2,008, valued at $17,704,362, while shipments of engine parts and accessories were valued at $7,240,362.

ASKS LAW AGAINST SABOTAGE

WASHINGTON — Secretary of War Stimson has asked Congress to authorize the President to invoke the war-time law against sabotage. Mr. Stimson notes that there is insufficient legislation to prevent subversive activity against munitions plants and utilities. The proposed Act by Congress would provide ten years imprisonment and $10,000 fine for violation.

SENATE VOTES RIGHT TO SEIZE PRIVATE PLANTS FOR DEFENSE

WASHINGTON—The Senate adopted an amendment to the conscription bill which will permit the government to commandeer private plants which refuse to co-operate in the national defense program. Under this proposal any private plant necessary for defense preparations which cannot reach an agreement for its use or operation by the War or Navy departments would be subject to condemnation proceedings. In addition, the government, after filing such proceedings may take possession of the plant and operate it either with its own workers or by contract with private firms. The amendment was accepted by a Senate vote of 69 to 16.

However, this needs some explaining for statutes, already existing, authorize the President to commandeer production facilities in an emergency. In this case the President would have to invoke the "war imminent" clause of the National Defense Act. Observers indicate, however, that the time is not ripe for such a move. Further in the Navy speed-up act of last June, the Secretary of the Navy is authorized to take over and operate such plants as do not cooperate and which he deems necessary to the national defense. He may also fix the compensation for such plants.

The passage of the present law repeals the right of the Secretary of Navy to fix compensation for plants, gives the Secretaries of Navy and War the right to enter into possession. However, the second war deficiency bill ($5,000,000,000) passed by the House and Senate, and sent back to the House for any changes, repeals the confiscation power granted to the Navy in June. At the last moment the Senate adopted an amendment applying the 7-8 per cent Vinson-Trammel profit limitations to the purchase of ordnance from industry. At the present time plant confiscation and the ordnance profit limit still depend on action of Congress in two bills still to be considered. However, the vote indicates peace-time commandeering may be granted.

Aircraft Industry, Soon To Employ A Million Men, Is Fertile Field For Labor Unions

NEW YORK—The aircraft and aircraft parts industry, which before long are expected to employ an estimated million men, are a tempting pasture for labor unions. They are in fact so lush a field for union expansion that both C.I.O. and A.F.L. consider aircraft their number one organizing job. Two C.I.O. units have jurisdictional claims in the industry: The United Automobile Workers with an aircraft division, and The United Radio, Electrical, and Machine Workers whose charter gives them C.I.O. sovereignty over the metal working shops. The A.F.L. claimant is the International Association of Machinists.

The unions are seeking to organize around certain standard grievances which the aircraft industry, as a comparatively new industry, provides in a rather pronounced degree. Thus, for example, the talking point of the auto workers union is the alleged wage differential which exists between auto and aircraft workers. The union promises to wipe out the differential which it claims runs as high as 35% for comparable skills in the two trades. Seniority and job security are also union demands.

The machinist union's appeal is directed largely at the craftsmen. Wage increases, preservation of craft prerogatives, and a voice in the settlement of grievances is the refrain of their marching song.

So far, the C.I.O. and A.F.L. have not come into direct competition. The labor committee of the National Defense Advisory Commission is expected to keep the decks clear of fratricidal strife. What has kept them out of each other's way is a rough geographical division of their energies. With approximately 60% of the industry located in the Far West, the A.F.L. has busied itself in the North and the C.I.O. has tackled the Southern California centers. The A.F.L. has the big Boeing plant in Seattle and the C.I.O. has just won a Labor Board election at Vultee in Downey and is petitioning for a poll at Ryan in San Diego. From these spots, both organizations are expanding outward.

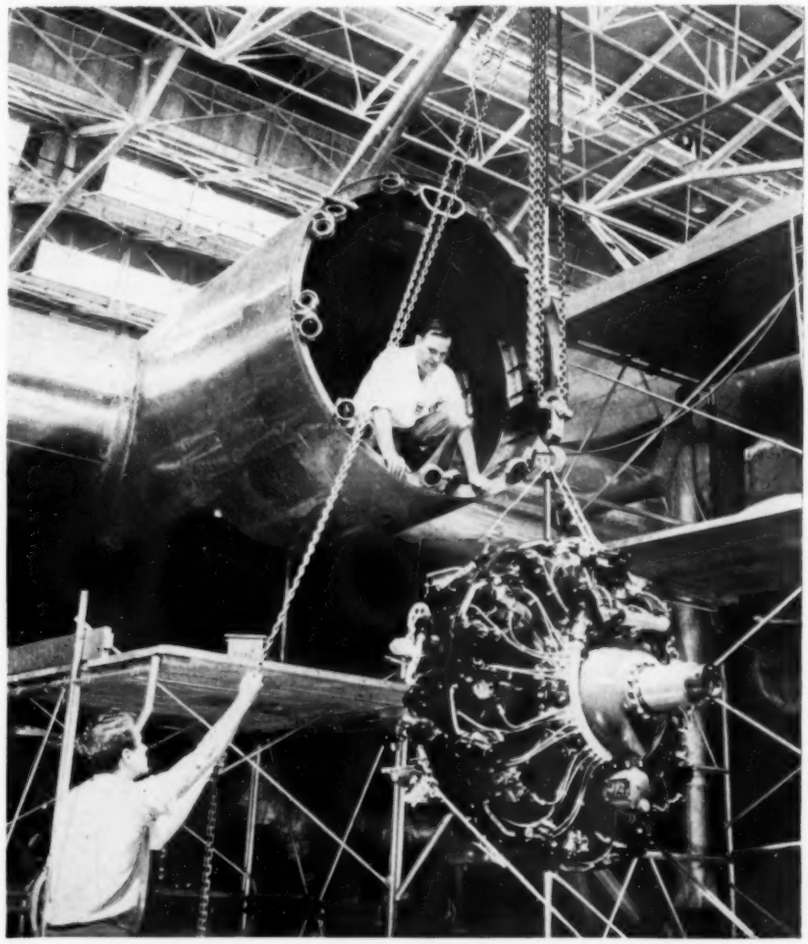
Aware of the sensitivity of public opinion on matters touching national defense, union leaders will call for strike action only as a last resort. The organization program calls for peaceful penetration through day-by-day organizing, and supplemented by Labor Board action. The relative peaceableness of the strategy however belies its determination. The unions are prepared to use all their resources in order to organize the aircraft industry.

DEFENSE BUYING ONLY HALF STARTED

WASHINGTON — Industry has yet to feel the real impact of defense buying. Although $6,600,000,000 has been appropriated, only about $1,800,000,000 has been placed under contract. The major part of the contracts covers Navy requirements with some extending into 1942, '43, and '44. Most of the work covered by the awards made to date is slow getting under way. On many of the larger contracts a good deal of engineering remains to be done before production can start. Once the excess profits tax and amortization bill is passed there will be probably two or two and a half times as much in contracts placed in the 60 days following as placed in the time since the appropriations were made. The new buying which is expected will require materials and labor immediately. New plant construction and equipment will call for specially urgent handling.

Congress May Revolt Against Plane Shipments To Britain

WASHINGTON—While the citizenry goes on believing that the aircraft industry is grinding out airplanes faster and faster for the Army and Navy, the Administration continues with its apparent determination to deliver nearly the entire output, except training planes, to Great Britain. But an element in Congress may revolt against this—with what possible success no one can say. Whether this contingency is part of the situation or not, Britain is seriously discussing with the Defense Commission and the Administration the possibility of a system of British airplane plants in this country to produce 1,300 planes per month for shipment abroad.



The Largest And Most Powerful Airplane—*Is the United States Army's giant bomber, the Douglas B-19. With a wing spread of more than 210 feet, the flying arsenal will weigh over 140,000 pounds, have four air-cooled 2000 H.P. engines as the one pictured above*

U.S.-Canada Defense Move May Result In Specialized Canadian War Production

MONTREAL—The recent U.S.-Canada defense understanding, culminating last week in the first meeting of the U.S.-Canada Defense Board, is expected to have far-reaching implications on the machine tool and metal-working industry, on the entire Canadian war production program. Although only limited agreements, plans, and arrangements are likely to be announced in the period immediately ahead, many observers believe that close cooperation between the U.S. and Canada on economic and financial matters is a logical development.

The U.S.-Canada agreement comes at a time when Canada's war industry development program was threatened with partial collapse. The limited facilities for making machine tools have been strained to capacity. Although additions are being made to existing plants, the industry itself is seriously short of skilled craftsmen. Specifically, Canada needs $65,000,000 of machine tools to equip the $170,000,000 new war plants which will be completed within the next six months. In aviation Canada has no facilities for making airplane engines, is forced to depend on England's supply which since the capitulation of France, has been negligible.

May Coordinate Production

An expected development from the U.S.-Canada defense move is an agreement which will see specialized production of war materials in each country. In this way items which can be made faster and at a lower cost in the U.S. will be manufactured there. Later they will be traded to Canada for articles which can be made faster and more cheaply in that country.

For example, Canada is expected to abandon plans for the erection of airplane engine factories, and it is confidently believed that arrangements will be made for the U.S. to supply all engines needed. Because of the abundant supplies of low cost power and raw materials such as cellulose, most of Canada's $170,000,000 new war plants are to manufacture explosives and war chemicals. Because coal and iron ore must be imported from the U.S., Canada's steel production facilities are small. Rather than expand, Canada will probably look to the U.S. for steel products, especially armor plate and battleships.

Other probable developments include the revision or elimination of tariff barriers in order to make procurement by both countries less costly. Financially the U.S. may assist by utilizing the new lending power of the Export-Import bank to take over responsibility for Canada's huge surplus of grain. U.S. money markets may be reopened to Canada, its credit position stabilized.

Plants Are Active

Meanwhile production continues at a fast pace. A $600,000 contract has been awarded to Aero-Marine Crafts Ltd., Toronto, for six large rescue boats. In Alberta an $8,000,000 government financed ammonium nitrate plant is under construction. It will be operated by Consolidated Mining Smelting Co. of Canada in conjunction with Canadian Industries Ltd.

Within seven months the Bren gun plant in Toronto will be producing five times as much as originally planned. The Canadian General Electric plant, Peterborough, Ont., has received large orders for precision equipment and artillery. The new gun plant at Sorel, Que., will be producing 25-pounder guns in a month. Some $10,000,000 is being expended to equip the plant with lathes for naval guns.

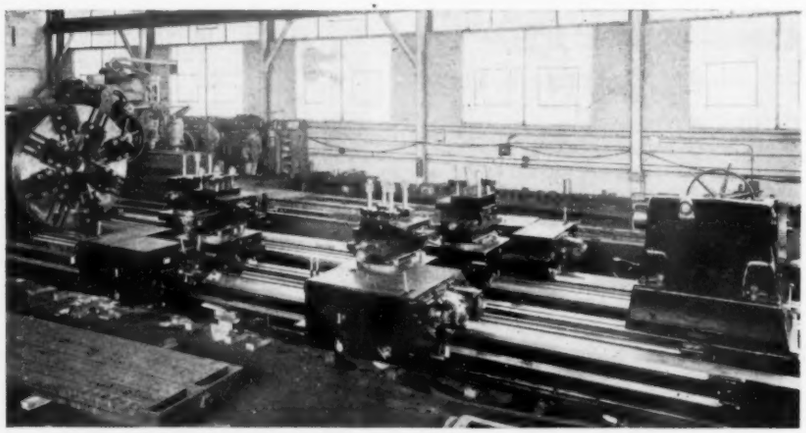
Some recent government defense orders are as follows: Machinery, Harrison Co., Montreal, $32,122; Consolidated Mining & Smelting Co., Ltd., Montreal, $334,500; Harrington and Richardson, Worcester, Mass., $13,188; Peerless Handcuff Co., Ltd., Springfield, Mass., $13,480; Munitions, Anaconda American Brass Ltd., New Toronto, Ont., $35,275; Remington Arms Co., Inc., Bridgeport, Conn., $74,268; Ordnance, Colt's Patent Fire Arms Mfg. Co., Hartford, Conn., $257,663; Aircraft supplies, Parmenter & Bulloch Co., Ltd., Gananoque, Ont., $17,800; and DeHavilland Aircraft of Canada Ltd., $10,368.

HEAVY ENGLISH BUYING IN SIGHT

WASHINGTON — Coordinated with our own defense is a plan being considered by the Defense Commission under which our government will approve placing of orders for 4,000 tanks for the British. Thus far our own plans call for 1,800. Preliminary to agreements to permit the British to place orders here, they have to accept American plans and standards. In case the orders fall through, plant capacity set up to meet them could be taken over without any hitch. Meanwhile great pressure is being put on plans for production on a large scale for both the British and our own planes of 20-mm cannon (1.6 in.). They have an effective range of 1,700 yards, would completely change aerial combat. There is other heavy British buying coming up for co-ordination.

Allison Seen To Be Expecting Additional Army Orders Soon

WASHINGTON—Word goes among machine tool and aircraft engine men visiting here that Allison has been buying more plant equipment than it needs for the present production schedule. Some observers take this to mean that the company is about to solve its alleged trouble with maximum horsepower output, and is expecting large additional orders from the Army. This conclusion is almost clinched by the fact that the Curtiss-Wright P40 and P40D, the terrific new Lockheed interceptor (500 mph top reported by the Air Corps) and the Bell ships, are being built at an increasing rate, presumably around the Allison engine.



Veteran Of World War I—*Although this gun lathe is one of twenty which has been idle since 1918, The Simmons Machine Tool Co. is rebuilding them as a part of the defense program. Each lathe weighs 990,000 pounds and, when dismantled, fills ten railroad cars*

WATCHING WASHINGTON

Defense Commission confused by lack of national unity. House passes bill authorizing President to requisition machine tools and other defense materials held here by foreign purchasers

By BLAINE STUBBLEFIELD

WASHINGTON—The Defense Commission is now at the bottom of a valley of confusion from whence it may reasonably expect to begin an early ascent to more light. The chaos is not as bad as it looks to the citizen observer, but it is bad enough. If the commissioners are surprised to find themselves so involved it is because some of them are not experienced in politics. However, the political set-up that created the Commission, plus the coincidence of the election, could hardly have produced any other result.

The basic trouble seems to be the lack of national unity on the issue of defense. This results from the fact that the U.S. is not in a war, which would pull all forces together. However, the country is by no means agreed on whether it wants a war, or whether it is even threatened with one. In a word the war party and the peace party each are trying to outdo the other, and the Defense Commission is in the middle.

The Commission and Congress are each blaming the other for failure to make adequate progress. Their exchanges are too long and complicated to detail here. But if you write it all in one equation and cancel out, the principal blame appears to land on the politicians, mainly in Congress. The defense manufacturers, while they are not free from selfish motives, and the Commissioners, who have almost no axes to grind, would be making commendable progress by now if the politicos would let them.

The present situation sees the Vinson-Trammel law still in force. It limits profits on aircraft and naval vessels to 8%. But the Administration has agreed that a section of the pending excess profits law shall repeal the profit limitation. Meanwhile, the Commission has succeeded in *clearing* some $4,000,000,000 in munitions orders with manufacturers like Douglas, Chrysler and others, who are willing or able to take a chance on amortization of plant expansion cost. Such companies expand on their own money, or on money borrowed from RFC. This is done under a "letter of intent" of the Government to order a given number of planes, tanks, etc., as an inducement to go ahead with tooling up. The reason the manufacturers are afraid to expand and tool up without an amortization guarantee of some kind, is that a Hitler peace or world disarmament are still possibilities. Under these conditions, manufacturers stand to lose a great personal investment—new plants ready to produce a product for which there would be no demand would be listed as a debit, not a credit.

To add facility to the financing of defense production, the Commission now proposes an innovation which it calls a "Bankable Contract". This will permit contractors to finance expanded plant and equipment by borrowing, or guaranteeing their own investments, with the contract as collateral. The Government would reimburse the contractor, not in additions to unit prices of the product, but in five equal annual installments covering the amount of his capital expansion cost. Then, cost of supplies and amortization of construction would be separated. This proposal must be approved by Congress. It is spectacular, but its importance should not be over-estimated. Lack of capital has not and is not holding up the defense program.

As for the future, the program waits upon two major acts by Congress: the excess profits tax, which will lay down a definite plan of expansion cost amortization, and the approval of the second supplementary defense appropriation of $5,000,000,000 by the Senate. The last stumbling-block to be removed will be the November election. Suppose it's Roosevelt. His ire at the dictators is much stronger than his dislike of business, and that should save the Commission's head, which might otherwise be lopped off to make room for a New Deal war council. FDR knows the Knudsons and Stettiniuses are better men than the Corcorans and Hopkinses. If it's Willkie, and if he's as strong as he said for defense, he will appoint a chairman to coordinate the Commission, which now has none.

4,361 JULY EXPORT LICENSES GRANTED

WASHINGTON—During July, 5 to 31 inclusive, the State Department's Division of Export Control received 6,242 applications for license to export goods on the President's prohibited list. Of this total, 5,397 were disposed of; 4,361 were granted; 236 were rejected on the ground the articles were essential to defense; 104 were returned with the request that further data be submitted; 696 were returned with the statement that no license was required for the contemplated exportation.

House Passes Requisition Bill

The bill auhorizing the President to requisition machine tools and other defense materials and equipment which have been ordered by foreign purchasers, but which have been refused export licenses, was passed by the House without a record vote. Although the bill has gone to the Senate, the Military Affairs Committee of the upper House is holding it up, waiting for reports from the Army, Navy, and other government agencies. The Senate group is said to feel that the House gave the measure too little study. Administration leaders of course are irked by this delay, which they feel is unnecessary and detrimental to the progress of defense production. The bill authorizes the President to pay a fair price for the goods requisitioned. If the owner is unwilling to accept the President's offer, he will be paid 50% of the sum offered and may sue for his price in the courts. Officials assured AMERICAN MACHINIST that the materials to be requisitioned are seriously needed by defense industries, but they would not comment on the question whether the bill is aimed at Japan, which is a heavy buyer of U. S. machine tools and other equipment.

Great Lakes May Boom

Great Lakes shipbuilding yards probably would come in for a considerable share of torpedo boat building, if the Navy goes into a big proposed mosquito fleet program. A letter from Secretary Knox to Senator Wiley of Wisconsin indicates that the Navy has some 30 types of small fighting boats under experimental orders and that they will be assembled at one point and given thorough tests. Thirteen Great Lakes firms built 25% of cargo shipping in the period of World War I. The small boats now planned could be brought out on rail cars or taken down the St. Lawrence. This is in addition to a big submarine building program.

Manufacturers, Not Dealers, Should Apply For Licenses To Export Machine Tools

WASHINGTON—The Administrator of Export Control has directed that, beginning September 1, 1940, applications for license to export machine tools be submitted by the manufacturer, rather than by a dealer, forwarding agent or other individual. This modification in the procedure has been found necessary in order to avoid duplication, and to ascertain from the best source, the manufacturer, whether from the standpoint of his productive capacity approval of the application will be contrary to the interests of National Defense.

The applications must be accompanied by information as follows:

Name of machine.

Type, model and size (catalogue designation).

Electrical equipment.—

(1) If D.C. Voltage, two or three wires.

(2) If A.C. Voltage, phase, cycle.

Metric or English dials, screws or gearing.

Variation from catalogue listing of machine.

Whether machine is complete and ready for shipment; or, if in production, percentage of completion and expected date of completion.

Special tooling or fixtures and selling prices thereof.

Product to be manufactured by the machine.

An indication of the effect of the order on production, such as the statement:

"We have no orders in hand for machines of this type, required for the United States Defense Program, for which requested delivery dates will not be met."

Applications for license to export which are submitted by dealers, export agents, or the purchasers, on and after September 1, will be returned for resubmittal by the machine tool manufacturer.

SENATE PASSES $5,128,169,277 BILL

WASHINGTON—The Senate passed the "Total Defense" appropriation bill of $5,128,169,277 and has sent it back to the House for concurrence and amendments, if any. This is the much talked-about "five billion dollar bill." The bill provides for (1) continued expansion of the Navy; (2) more complete equipment for a land force of about 1,200,000 men; (3) a reserve stock of tanks, guns, artillery, ammunition for another 800,000 men, or a total of 2,000,000 if full mobilization is ordered; (4) plant expansion, public and private facilities necessary for the production of critical items such as guns, bombs, armor, and ammunition; (5) procurement of 4,028 additional planes with spare engines for Army and Navy.

SENATE LOOKS AT 20 TO 50% EXCESS PROFITS TAX BILL PASSED BY HOUSE

WASHINGTON — Last week the House passed the defense excess profits tax bill. Although the Senate's Finance committee sat in at hearings with the House Ways and Means committee with the intention of later dispensing with Senate hearings, it seems now that the Senate will hold hearings notwithstanding. What changes the Senate will make or how long it will take is unpredictable.

As it stands now the tax bill: (1) Would levy an excess profits tax on abnormal industry profits due to the government expenditure of $14,000,000,000 for defense. The tax would range from 20 to 50 percent. (2) Permit industries who are expanding their plants to charge 20 percent of the cost against their taxes each year for a period of five years. (3) Suspend the Vinson-Trammel profit limitation which is 8 percent of contract price or 8.7 percent of performance cost for the duration of the defense program.

The profit limitation may be placed on ordnance orders if the conscription bill carrying an amendment to that effect is passed. Then if the Senate passes the tax law as passed by the House, the profit limitation on Navy, Airplane and Ordnance construction will be suspended.

The legislation was drawn so that small or new corporations and those lately unprofitable will not suffer. The totals to be raised by the bill are to be greater than would have come from the first draft. Tax experts of industry have provided many usable suggestions.

U. S. Government Contracts Awarded to Metal-Working Firms

(Other Contracts on Page 682j)

Contractor	Gov't Agency	Commodity	Amount
Crucible Steel Co. of America, New York, N. Y.	War	Shot	$113,236
Motor Wheel Corp., Lansing, Mich.	War	Shell	67,108
Continental Motors Corp., Muskegon, Mich.	Navy	Engines	1,442,275
Douglas Aircraft Co., Inc., Segundo, Calif.	Navy	Airplane parts	13,639
Douglas Aircraft Co., Inc., Santa Monica, Calif.	Navy	Airplane parts	53,869
American Bantam Car Co., Butler, Pa.	War	Trucks	173,070
Ford Motor Co., Detroit, Mich.	Procurement	Trucks	1,150,920
American Locomotive Co., New York, N. Y.	War	Artillery carriages	1,132,200
United Shoe Machinery Corp., Boston, Mass.	War	Guns	1,316,485
General Electric Co., Schenectady, N. Y.	War	Howitzers	201,090
Variety Aircraft Corp., Dayton, Ohio	War	Stand assemblies	177,500
Crucible Steel Co. of America, New York, N. Y.	War	Forgings	177,098
National Forge & Ordnance Co., Irvine, Pa.	War	Forgings	65,500
Struthers Wells-Titusville Corp., Titusville, Pa.	War	Forgings	63,500
American Brake Shoe & Foundry Co., Chicago, Ill.	War	Shell forgings	160,500
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.	War	Parts for pistol	40,330
Heppenstall Co., Pittsburgh, Pa.	Navy	Forgings	166,344
Bethlehem Steel Co., Bethlehem, Pa.	Navy	Forgings	1,066,738
Camden Forge Co., Camden, N. J.	Navy	Forgings	134,877
Struthers-Wells-Titusville Corp., Titusville, Pa.	Boston Navy Yd.	Forgings	22,113
Revere Copper & Brass Inc., Baltimore, Md.	War	Cartridge discs	1,017,433
International Harvester Co., Washington, D. C.	Navy	Tractors	132,137
Diamond T. Motor Car Co., Chicago, Ill.	War	Trucks	3,249,414
Corbitt Co., Henderson, N. C.	War	Trucks	1,396,664
General Motors Corp., Cleveland, Ohio	Navy	Propelling machinery	5,732,476

Inventors Council May Persuade Congress To Appropriate $150,000

WASHINGTON—That new National Inventors Council is going to get $150,000 to run on—if the Department of Commerce can persuade Congress. The patent office, which is in the Department of Commerce, has as its chairman, Charles Kettering. This council will examine all the unsolicited bright ideas, and will also farm out perplexing defense problems to the country's known capable inventors and research organizations. Some of the funniest dinguses on earth are on file with the Army and Navy and Aeronautics Advisory Committee, and the Patent Office. But they won't tell you about them because they are afraid people might laugh. Wacky inventors are not to be discouraged because they are the ones who create the telephones, the submarines, the airplanes, rubber tires, steamboats. Just one such stroke of genius might tip the scales of a war.

INSIDE DETROIT

New 1941 cars lean toward torpedo-styling. General Motors uses it exclusively. More power, greater economy for engines; transmissions improved with regard to gear clashing, ease of shifting

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—Enough has been seen or learned of 1941 models to provide a broad picture of improvements to be offered a car-hungry public. There won't be many "tremendous surprises", and many of the important changes have been mentioned during recent months. But by and large, most manufacturers have made a real effort to provide passenger cars that are more attractive, roomy, powerful, responsive, and easier to drive than outgoing models, plus numerous detail refinements that increase comfort, safety and reliability of service.

In short, despite price tags that may be three to five per cent higher to compensate for the rise in cost of materials and labor, 1941 models truly offer that extra yearly measure of value for which the automobile industry is famous. There has been no attempt to stint because of unsettled world conditions or preoccupation with national defense.

At first glance, the most striking thing about many 1941 models is adoption of Torpedo styling almost lock, stock and barrel. General Motors, originator of the torpedo body, will offer it exclusively, including a new version, on Pontiac, Oldsmobile, and Buick. There is also the strong possibility that Chevrolet will again take the bull by the horns and do something unusual in the mass market. Witness the Special Deluxe of 1940.

Nash Favors Torpedo Type

All three Nash lines are torpedo-type, including the new entry into the low-price field—the Ambassador 600. Studebaker has a new Land Cruiser Model and now offers the purchaser of Commanders or Presidents a choice of conventionalized or torpedo styling. And as said previously, Hudson revised the rear-quarter of its bodies to achieve the Torpedo silhouette. Willys has a larger and more handsome car and will put a new name on it for the coming year.

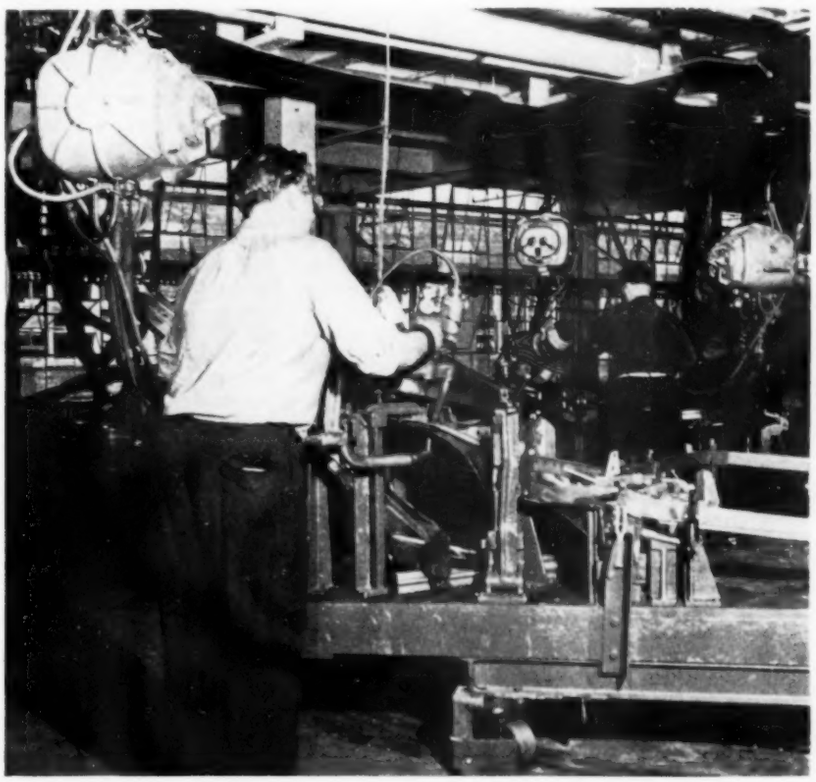
The remainder of the field—Chrysler, Ford and Packard—seemingly prefer to continue evolution of body lines along the courses indicated in 1940 or earlier. Retention of visible runningboards on Chrysler products leads to the opinion that bodies have not been widened to torpedo dimensions, although it is believed that airflow principles will be considerably more evident. Packard's smaller cars retain runningboards, are apparently about one inch wider through the body compartment. Ford men have been enthusiastic about the styling evolved for Lincoln Zephyr and used in various degrees on Ford and Mercury models. This enthusiasm, plus acknowledged functional design and the comparatively short model-changeover period make it appear that Ford products will be brightened externally and internally and the frontal appearance will be modified.

Others Use Torpedo Styling

Two versions of torpedo styling will be used on the Buick, Oldsmobile and Pontiac lines for 1941. The conventional narrow body with exposed running boards has disappeared. All three makes utilize trunk-back torpedo styling revised somewhat from last year, and a new fast-back torpedo, in which the roofline curves sharply from the windshield to the rear bumper without a trunk protuberance. Buick uses the fastback torpedo body on its Special whereas Pontiac has made it the middle-priced model, and it is believed that Oldsmobile will do likewise.

LARGE PROCUREMENT ORDERS

DETROIT—Procurement orders for large quantities of war material are expected to shower down upon Michigan auto and parts plants within the next month or six weeks. Orders for more tanks, shell, and 700 Packard marine engines for mosquito boats are in the offing, plus new items like cannon. Most imminent, however, is a contract for at least 25,000 machine guns, which may be placed before this is published. Likely recipient, Saginaw Steering Gear Division, General Motors, already has an educational order for 500 machine guns, spent one-fourth of the $750,000 allotment for new machine tools.



Merry-Go-Round Conveyor—*Not all the improvements in the auto industry are made on cars. Among numerous new equipment installations in the Lincoln $1,000,000 body plant is a 250 ft. conveyor for clamping and assembling the components of side frames for the Lincoln-Zephyr*

U. S. Government Contracts Awarded to Tool Makers

(Defense Contracts on Page 682h)

Contractor	Gov't Agency	Commodity	Amount
Henry Vogt Machine Co., Louisville, Ky.	War	Machined shell	$185,155
Allis-Chalmers Mfg. Co., Milwaukee, Wis.	Navy	Housing forgings	82,720
National Forge & Ordnance Co., Irvine, Pa.	Navy	Gun forgings	504,309
General Machinery & Supply Co., San Francisco, Calif.	Navy	Chain hoists	13,701
Warner & Swasey Co., Cleveland, Ohio	War	Turret lathes	63,420
Judson-Pacific Co., San Francisco, Calif.	Interior	Traveling cranes	64,920
Perine Machinery & Supply Co., Seattle, Wash.	Navy	Boring mill	22,957
Rockford Machine Tool Co., Rockford, Ill.	Navy	Planers	49,088
Lloyd & Arms Inc., Philadelphia, Pa.	Navy	Radial drills	17,230
Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.	War	Cartridge loading machine	11,500
Brown & Sharpe Mfg. Co., Providence, R. I.	War	Milling machines	38,433
National Broach & Machine Co., Detroit, Mich.	War	Milling machines	102,560
Kingsbury Machine Tool Corp., Keene, N. H.	War	Drilling machines	24,133
The Lapointe Machine Tool Corp., Hudson, Mass.	War	Sharpening machines	10,066
Henry Prentiss & Co. Inc., New York, N. Y.	War	Surface grinders	21,699
	War	Drilling machine	12,626
	War	Turret lathes	21,212
Jones & Lamson Machine Co., Springfield, Vt.	War	Thread grinder	14,519
Lloyd & Arms Inc., Philadelphia, Pa.	War	Engine lathes	20,185
The National Acme Co., Cleveland, Ohio	War	Screw machines	56,524
Kearney & Trecker Corp., Milwaukee, Wis.	War	Threading machines	37,450
National Twist Drill & Tool Co., Detroit, Mich.	Navy	Twist drills	71,053
Builders Iron Foundry, Providence, R. I.	Navy	Rifling machine	14,500
Ingersoll-Rand Co., Knoxville, Tenn.	TVA	Core drills	29,400
Gould & Eberhart, Newark, N. J.	Navy	Gear cutting machines	21,593
William Sellers & Co. Inc., Philadelphia, Pa.	Navy	Machine, traverse radial drilling	35,805
Lodge & Shipley Machine Tool Co., Cincinnati, Ohio	Navy	Engine lathes	25,509
Cincinnati Milling Machines & Cincinnati Grinders Inc, Cincinnati, Ohio	War	Milling machines	75,900
Taylor Parker Co., Norfolk, Va.	Navy	Twist drills	16,292
Hendey Machine Co., Torrington, Conn.	War	Lathes	18,800
Landis Tool Co., Waynesboro, Pa.	War	Grinding machines	23,670
Enterprise Tool & Gear Corp., Detroit, Mich.	War	Gears	52,012
Mine Safety Appliances Co., Pittsburgh, Pa.	Navy	Power presses	18,280
The American Tool Works Co., Cincinnati, Ohio	Navy	Engine lathes	30,146
Bullard Co., Bridgeport, Conn.	Navy	Vertical lathes	26,142
Modern Tool & Die Co., Philadelphia, Pa.	War	Gages	18,225
Sier-Bath Co. Inc., New York, N. Y.	War	Gears	24,667
Detroit Bevel Gear Co., Detroit, Mich.	War	Gears	17,052
Van Dyck, Churchill Co., New York, N. Y.	War	Turning machines	77,565

MACHINERY EXPORTS DECLINE

WASHINGTON — Exports of power driven metal-working machinery amounted to $14,906,312 for the month of July. This was a 20 percent decline from the total for the month of June. Exports of lathes dropped from $3,869,946 to $2,377,133; drilling machines from $1,176,998 to $844,539, and rolling mill machinery decreased from $2,884,832 to $1,006,770 in June. Exports of milling machines and grinders were about the same in each period. Shipments of metal-working machinery, other than power driven, were valued at $582,087 in July, a slight decline from the June figure.

Gov't Field Procurement Offices Simplify Placing of Contracts

WASHINGTON—A great many defense orders have been awarded recently by the various Field Procurement Planning Offices of the War Department. Such items as ammunition, weapons, fire control instruments, tools, machinery, and supplies used in arsenals and for maintenance of ordnance have been purchased through these field offices and at the same time have obviated the necessity of manufacturers coming to Washington. The field offices are in the following Army Ordnance Districts:

- Baltimore, Md.—Purchases Baltimore area — being handled through Philadelphia.
- Birmingham, Ala.—302 Comer Building.
- Boston, Mass.—2004 Post Office and Court House Building.
- Chicago, Ill.—309 West Jackson Boulevard.
- Cincinnati, Ohio—521 Post Office Building.
- Cleveland, Ohio — 1524 Keith Building.
- Detroit, Mich. — 611 Federal Building.
- Los Angeles, Calif.—Army Ordnance Office, 409 Chamber of Commerce Building.
- New York, N. Y.—Room 1214, 90 Church Street.
- Philadelphia, Pa.—1417 Mitten Building.
- Pittsburgh, Pa.—1032 New Federal Building.
- Rochester, N. Y.—1118 Mercantile Building.
- St. Louis, Mo.—935 Customhouse.
- San Francisco, Calif.—118 Federal Office Building
- Springfield, Mass.—3640 Main Street.
- Wilmington, Del.—Army Ordnance Office, Nemours Building (for explosives only).

Pontiac and Olds will follow almost identical policies for 1941: three torpedo models, two wheelbases, and optional use of a six or eight cylinder engine in any model or wheelbase. Pontiac apparently will use 119 and 122 in. wheelbases; Olds, 119 and 126. The 116 in. wheelbase has been dropped from both lines. Plymouth had the longest wheelbase in its price class during 1940, and it is likely that both Chevrolet and Ford will lengthen the chassis by two or three inches in order to meet that competition, and to get out of the immediate neighborhood of the Studebaker Champion and Nash Ambassador 600.

In the Ambassador 600, Nash has a sensational entry into the low price field. The car has 112-in. wheelbase, but is 194 in. over all.

More power, greater economy and snappier response will be almost universal in 1941 engines because of improvements made feasible through the new higher-octane fuels to be marketed this fall. Improved carburetion, somewhat higher compression, improved combustion chamber design and better engine bearings are means of accomplishing the above ends. Buick captures the stage with its "fireball eight" coined to denote the flame propagation characteristics of its engines, which introduce compound carburetion for the first time in production eight-cylinder motors.

General Motors will not be alone in the use of better engine bearings. Chrysler products, judging by the Plymouth, will have new bearings with thin babbitt linings in heavy steel backings, a relatively difficult attainment.

Transmissions have been improved with regard to gear clashing and ease of shifting. General Motors will continue the Hydramatic drive in improved form on Olds as optional equipment and offer it also on the Cadillac group. Chrysler will make the fluid drive available on the Chrysler six, DeSoto and Dodge, and press releases might be construed as including the Plymouth in the not too distant future. DeSoto announces the Simplimatic Drive, which is probably the vacuum-operated semi-automatic transmission mentioned previously. This drive in combination with the fluid drive, will accomplish most of the things possible with the full automatic transmission, but probably cost less.

NAMES in the NEWS

Wins Promotion

JOHN H. STAPLETON

New Traffic Manager

ELWOOD G. STEWART

Elected President

H. M. HUBBARD

Howard M. Hubbard has been elected president of Greenfield Tap & Die Corp., Greenfield, Mass. Mr. Hubbard replaces D. G. Millar, who resigned as president to become chairman of the board. For the last ten years Mr. Hubbard has been associated, as secretary-treasurer, with the Harris-Seybold-Potter Co. Francis A. Smith, for several years vice-president and general manager, has resigned from active service in the Corporation.

John H. Stapleton has been named assistant manager of sales for the New York district of Carnegie-Illinois Steel Corp., Pittsburgh, Pa. Mr. Stapleton has been associated with the Carnegie subsidiaries since 1917.

Merle C. Nutt succeeds his father, L. E. Nutt, as president of Moline Iron Works, Moline, Ill. Mr. L. E. Nutt has been named chairman of the board.

John R. Haysak has been named vice-president in charge of factory management of Ferry Cap & Set Screw Co., Cleveland, Ohio.

G. S. McKee, production manager of Talon, Inc., Meadville, Pa., has been elected a director of the Hall Planetary Co. of Philadelphia.

Floyd Stroup is now superintendent of the melt department of Copperweld Steel Company's new plant at Warren, Ohio.

Carroll F. Brown has been appointed superintendent of industrial relations at the Duquesne Works of Carnegie-Illinois Steel Corp.

Herman J. Hofmann, assistant open hearth superintendent of Lukens Steel Co., Coatesville, Pa., since April, 1926, has been promoted to open hearth superintendent, succeeding J. D. Walters who has resigned.

John P. Davey, chief of production planning at the Curtiss Aeroplane Division of Curtiss-Wright Corp. in Buffalo, has been transferred to the company's plant in St. Louis to develop expanding operations there.

J. A. Butler has been appointed comptroller of the Falk Corp., Milwaukee, Wis.

R. Volbrecht has been appointed to the New York merchandising sales staff of Cutler-Hammer, Inc., Milwaukee, Wis.

F. J. Geiger has been named assistant manager of the electrical department of Allis-Chalmers Mfg. Co. In this capacity Mr. Geiger will be in complete charge of sales and engineering at the company's Norwood, Ohio, plant. Frank R. Freyler has been named to succeed Mr. Geiger as assistant manager of sales and E. C. George and A. Thorsen have been respectively named to the posts of acting works manager and assistant works manager.

Elwood G. Stewart, who has been acting traffic manager since November 1939, has been appointed traffic manager of the concern. Mr. Stewart had been assistant traffic manager since May 1935.

Ralph O. Wirtemburg, formerly manager of the New York office, New Departure Division, General Motors Corp., has been appointed eastern sales manager. Francis B. Wasley has been named to succeed Mr. Wirtemburg in New York. Mark Goedecke has been named to succeed Mr. Wasley in Philadelphia.

J. L. Wagoner has been promoted to agency sales section manager for the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PLANT EXPANSION

Sterling Engine Co., Buffalo, N. Y., manufacturer of marine engines, will erect a test-room addition to its plant.

Lockheed Aircraft Corp. is erecting a new research building at its plant in Burbank, Calif.

Ryan Aeronautical Co., San Diego, Calif., is erecting a $75,000 addition to its factory on an area of 26,280 sq.ft.

United Aircraft, East Hartford and Stratford, Conn., will further expand its plants at an estimated cost of $15,000,000. Another large addition to the Pratt & Whitney aircraft engine factory in East Hartford is planned. This will bring its total floor area to approximately 1,500,000 sq.ft.

The Holo-Krome Screw Corp., Hartford, Conn., is completing a factory addition to its plant in Elmwood.

Douglas Aircraft Co., Santa Monica, Calif., will erect a new aircraft manufacturing plant at Long Beach, Calif. This recent addition is a part of a program which includes extensive additions and improvements to the company's plants which is scheduled to cost more than $20,000,000.

Following the government approval of a $34,000,000 loan to Curtiss-Wright Corp. the construction of an airplane plant in Buffalo is considered a certainty. Expenditures may range between $8,000,000 and $10,000,000.

BUSINESS ITEMS

Willard Tool Co., Bridgeport, Conn., has been acquired by the Auto Ordnance Co., New York.

Bumstead-Woolford has been appointed exclusive sales representatives for the Oregon and Washington territory for the Foxboro Co., Foxboro, Mass.

The Ohio Gear Co., Cleveland, Ohio, has been appointed national distributors for the products of the Browning Mfg. Co., Maysville, Ky.

Vultee Aircraft, Inc., has acquired the properties of the Stinson Division of the Aviation Mfg. Corp., which consists of a new factory in

Dies at 54

TYLER W. CARLISLE

Passes Away

WALTER P. CHRYSLER

Nashville, Tenn., and a plant at Wayne, Mich. Harry Woodhead, president of the Aviation Mfg. Corp., has been elected chairman of the board of Vultee Aircraft, Inc.

Bullard Co., Bridgeport, Conn., manufacturer of machine tools, is beginning the construction of two new plant units.

The Dayton Rogers Mfg. Co., Minneapolis, Minn., is expanding their plant at Minneapolis by adding a new one-story factory building. The new addition will house new machinery and other special equipment.

OBITUARIES

Walter P. Chrysler, for many years president and chairman of the board of the Chrysler Corp., died recently at the age of 65. In 1916 Mr. Chrysler was president and general manager of Buick and early in 1919 first vice president of General Motors Corp. in charge of operation.

In 1908, at the age of 33, Mr. Chrysler bought his first automobile. However, he did not buy the car to operate. He bought it to study, to take apart and put together again several times. Sixteen years later he built the first car to bear his name.

In 1919 Mr. Chrysler resigned with the intention of retiring. However, he couldn't remain inactive long and soon accepted the position of executive vice president and general manager of the Willys-Overland Co. which was then involved in serious financial difficulties. Within two years he placed this company's business on a sound basis.

Since June 1925 when the Chrysler Corp. was formed to its fifteenth birthday in 1940, Chrysler Corp. had sold more than 8,000,000 Plymouth, Dodge, DeSoto and Chrysler cars and Dodge trucks. In 1930 the 77-story Chrysler building, named after Mr. Chrysler, was opened in New York City. Mr. Chrysler was a member of the Society of Automotive Engineers.

Tyler W. Carlisle, president, The Strong, Carlisle & Hammond Co., Cleveland, Ohio, died recently at the age of 54. For over 25 years Mr. Carlisle had been actively identified with the growth and development of the organization. In 1916, after only six years of service, he was advanced to the position of Sales Manager and a director of the company.

Hubert C. Hart, noted inventor, died at the age of 97. Mr. Hart headed his own manufacturing company and manufactured cutlery and edged tools for 70 years.

Nelson L. Fortin, 51, district manager in Milwaukee for the Revere Copper & Brass Co., died.

James Hughes, 57, western representative for S. T. Stevens, Inc., Detroit, Mich., died recently. Mr. Hughes, a former United States Congressman, joined the Stevens company in 1915.

William L. Fewsmith, manager of publicity and advertising for Robins Conveying Belt Co., Passaic, N. J., died after a brief illness. Mr. Fewsmith first joined the company in 1913 as a civil engineer.

Charles F. Drew, secretary and treasurer of the Rust Engineering Co., Pittsburgh, Pa., died recently.

MEETINGS

American Society for Metals. Annual convention. Hotel Statler, Cleveland, Ohio. Oct. 21–25

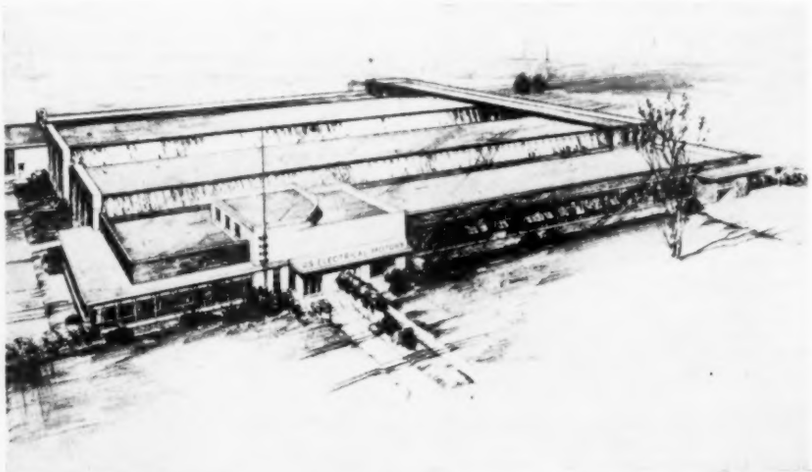
American Welding Society. Annual convention. Hotel Cleveland, Cleveland, Ohio. Oct. 20–25.

The Wire Association. Annual convention. Carter Hotel, Cleveland, Ohio. Oct. 17–23.

American Society of Tool Engineers. Semi-annual convention. Cincinnati, Ohio. Oct. 17–19.

American Gear Manufacturers Association. The 23rd semi-annual convention, Skytop Lodge, Skytop, Pa. October 14, 15 and 16, 1940.

Society of Automotive Engineers. National tractor meeting, Schroeder Hotel, Milwaukee, Wis., Sept. 24–25. Annual dinner, Hotel Commodore, New York, N. Y., Oct. 14.



Reversing Horace Greeley—*Although most eastern manufacturers are going to the west coast to build branch plants, U.S. Electrical Motors, Inc., is building a new complete production plant at Milford, Conn. Above an architect's drawing shows how the plant will look when it is finished*

SHOP EQUIPMENT NEWS

Gleason "Revacycle" Bevel Gear Cutting Machine Finishes Straight-Tooth Pinions by New Principle

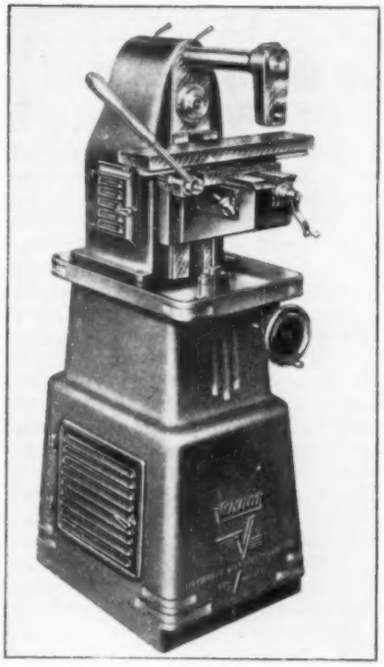
A mass production machine entirely new in principle and design, developed for cutting straight-tooth bevel gears such as used in automobile differentials, washing machines and textile machinery, has been developed by the Gleason Works, 1000 University Ave., Rochester, N. Y. Known as the "Revacycle", this machine provides an exceptionally fast method of cutting straight bevel gears, as these are both roughed and finished in one operation with a single disk cutter.

The machine cutter has a number of radially arranged roughing blades followed by a number of similarly arranged finishing blades, with a gap between the last finishing and the first roughing blade. This cutter is mounted on a reciprocating slide, and as the cutter rotates in engagement with the gear blank, it moves along the tooth, the action being similar to that of a milling cutter. As the cutter moves from the small to the large end of the blank, the roughing blades cut out a tooth space. On the return stroke the finishing blades finish the tooth space which has just been roughed. The blank is held stationary during cutting, and at the end of each return stroke of the cutter the blank is indexed at the gap in the cutter blades. Each revolution of the cutter completes a tooth space. Conjugate tooth forms are produced as a result of the cutter motions and the shape of the cutter blades.

Except for chucking, operation of the "Revacycle" is entirely automatic. There are no chucking delays, however, as the machine is provided with a rotary work-holding turret with three spindles. Thus gears are removed and blanks loaded at two stations while cutting takes place at the third. Turret indexes automatically.

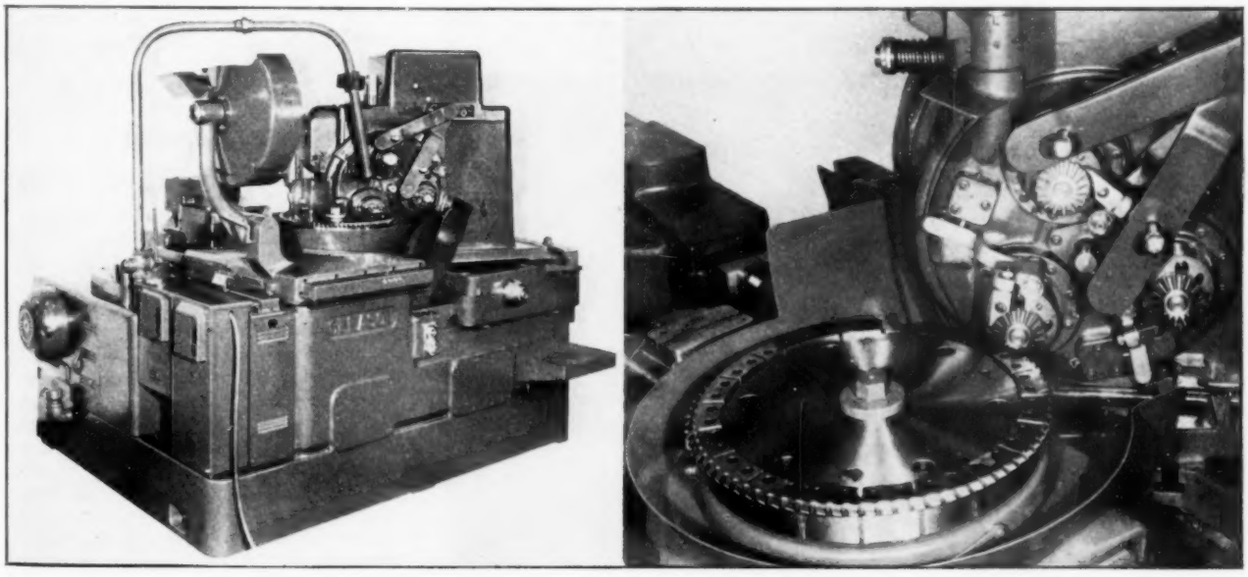
Cutter spindle is rigidly mounted on precision anti-friction bearings with provision for periodic greasing. Lubrication of all moving parts other than the spindle is provided by a circulating oil system. Work is held in place by a heavy spring and is released by a hydraulic piston. Clamping takes place automatically when the blank is properly chucked; releasing is also automatic. Index for the work spindle is of the notched plate type with hardened and ground index plates. A built-in conveyor deposits chips outside the machine. Included is a hydraulic unit which supplies power for clamping the turret, for chucking the blank and for operating the chip remover.

Specifications: Maximum cone distance, 3 in.; maximum face, 1½ in.; coarsest pitch, limited by maximum whole depth of 0.450 in.; ratios, 1:1 to 2:1; pitch diameters from 2¾ in. to 5½ in.; index range from 8 to 40 teeth.



Vernon Hand Milling Machine Finishes Parts at High Speed

An addition to the Vernon line of precision milling machines offered by Machinery Mfg. Co., 3636 Irving St., Vernon, Los Angeles, Calif., is the No. 0 hand miller for high speed milling of small parts. With hand lever operated rack and pinion feed, this machine is a precision tool providing the accuracy and sturdiness re-



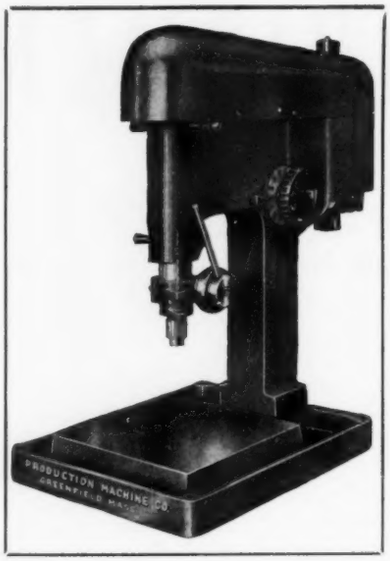
quired for modern output methods.

Two standard speed ranges are available—100 to 1,000 r.p.m., and 150 to 1,500 r.p.m. Variable drive is fully inclosed. Heat-treated and ground spindle is mounted on Timken tapered roller bearings. Power is provided by a ½-hp., 1,750 r.p.m. motor. Over-all height of this tool is 58 in. Net weight is about 650 lb.

Reed Sensitive Bench Drill Has No Exposed Moving Parts

Production Machine Co., Greenfield, Mass., has made available a high-speed sensitive bench drill which has no exposed moving parts other than the drill itself. A development of the Reed line of sensitive drills which Production Machine Co. is now building, this No. 25 drill is claimed to have unusual strength and to be unique in its simplicity. It has been designed as a production tool for accurate work, and as an all-purpose machine capable of unusual speed and adaptable to a wide variety of drilling operations.

Variable speed drive, completely enclosed, provides an infinite number of spindle speeds ranging from 2,000 to 10,000 r.p.m., instantly available by turning a handwheel. An indicator shows the running speed.



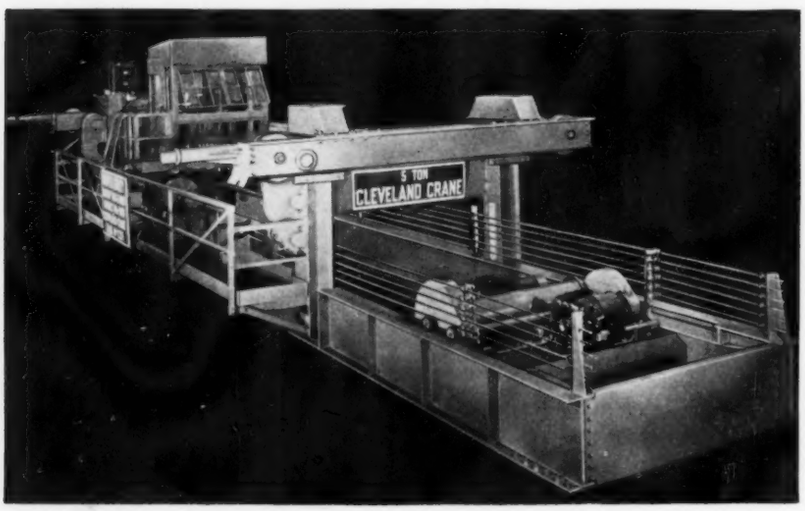
Specifications: center of spindle to column, 7 in.; maximum distance from chuck nose to table, 6 3/16 in.; adjustment of sliding head, 3 in.; maximum spindle travel, 3¾ in.; drill sizes, No. 70 to ¼ in. Motor delivers ½ hp. at 110 volts, single phase, 60 cycle, 3,450 r.p.m. Spindle is carried in two sealed precision ball bearings. Weight complete is 195 lb.

Cleveland 5-Ton Cantilever Cranes Permit Handling Loads in Adjacent Bays

Cleveland Crane & Engineering Co., Wickliffe, Ohio, has built two cranes of special construction which are designed materially to reduce handling time between bays. These cranes have a cantilever extension which makes it possible for the trolley to go beyond the crane runway and convey loads into the adjacent bay. The crane bridge is underslung to permit the trolley to clear the runway girder.

Construction is of all-welded steel throughout, with all bearings of the anti-friction type. Spring-type bumpers are provided for the trolley and one side of the bridge. Gear cases are oil tight. Bridge wheels, gears, and pinions are all of tool steel.

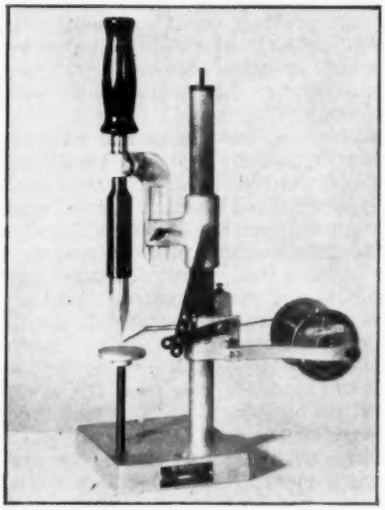
Cranes are operated from a closed-type cab mounted on one end of the bridge opposite the bridge extension. Capacity of each crane is 5 tons, with a span of approximately 37 ft. Vertical travel of hook is 86 ft. Hoisting speed is 40 ft. per min., trolley speed is 100 ft. per min., and bridge speed is 350 ft. per min.



Spot Soldering Machine Leaves Both Hands Free

A spot soldering machine for use in places where both hands are necessary to hold the parts together has been developed by Electric Soldering Iron Co., Deep River, Conn. Any industrial soldering iron may be used with the device.

Machine is operated by a treadle which advances the iron straight down. Contact of iron tip with work is cushioned by a spring suspension.

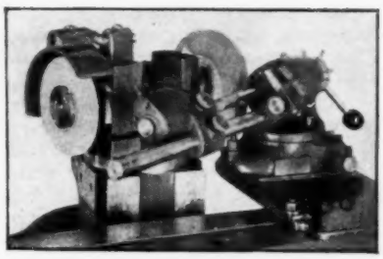


As iron returns from work, solder is automatically fed forward. Feeding of solder may be accurately regulated by adjustment of pawl lever which engages feeding gears. Solder of any diameter up to ⅛ in. may be used. Solder feed tube is adjustable to guide solder to any desired point. Shipping weight of the device, complete with chain and treadle, but without iron, is 13 lb.

Tap Grinding Attachment Can Be Set Up Quickly

Quick set-up for chamfer sharpening of many styles of taps is one of the features of the No. 2 tap grinding attachment offered by Covel Mfg. Co., Benton Harbor, Mich. This attachment is easily mounted on any grinding machine having a wheel of 1¼-in. face or less, and having longitudinal and transverse adjustment similar to a universal cutter and tool grinder, with a flat table 4½ to 6½ in. wide.

No cams, gears or collets are required to hold the tap or to get proper eccentric relief. Small taps, from the No. 6 to the ½-in., are held



in a three-jaw chuck, while larger taps are held on centers. Spindle is mounted in dust-protected ball bearings.

In operation the attachment is set up and securely fastened to the grinding machine, then adjusted for the kind and size of tap to be ground. The face of the flute is aligned with a lip rest and the amount of eccentric relief adjusted. Grinding is accomplished by rocking a knob back and forth, movement of which is limited by stops.

For a maximum of ease and accuracy, the oscillating spindle revolves in ball bearings, so that the operator can feel the cut of the grinding wheel. When one tooth has been ground, operator indexes the tap to the next tooth by locating it from the lip rest. The lip rest is adjustable for large and small, or right- and left-hand taps.

Lees-Bradner Heavy Thread Milling Machine Especially Adaptable to Munitions Production

The Model CT chucking type heavy thread milling machine introduced by the Lees-Bradner Co., 6210 Carnegie Ave., Cleveland, Ohio, is arranged for the generation of threads by means of the ring type or hobbing process, using either shank or shell type cutters. Having a 13-in. hole through the work spindle and a swing over the ways of 24 in., this machine is adapted for the threading of propeller blades, propeller hubs, breech blocks, gun barrels, landing gear components, and other similar parts of considerable size which require the utmost in precision threading.

Machine is driven by two motors, the cutter drive motor being mounted directly on cutter head, and the work head motor being mounted partly in the base. A separate motor-driven coolant pump is furnished. Through the use of the two main driving motors, the long cutter head drive shaft often employed is eliminated.

Control is through pushbuttons; the two main driving motors are electrically interlocked so that the headstock motor cannot be operated unless the cutter is rotated. Cutter head traverse is controlled by limit switches; stops for actuating these switches are at the front of the machine readily available for adjustment. Control of direction of rotation of the two main driving motors is through reversing drum switches conveniently located at the front of the machine. Drive from both motors is through V-belts; both drives are completely enclosed.

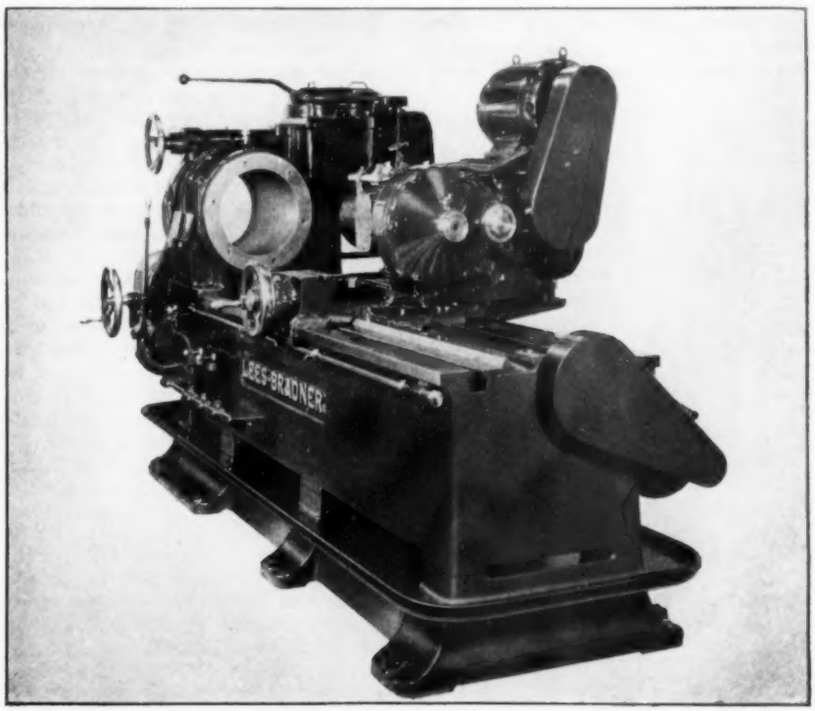
Work spindle, driven by a precision worm and worm wheel, is arranged for the installation of various types of work holding fixtures such as collets, three or four jaw chucks, or special fixtures. Spindle rotates in large hand scraped, hard bronze bearings. Lead gears and feed gears are independent of each other. Since many of the threads of the sort which are generated on this machine must register angularly and axially, provision has been made for adjusting the work spindle and cutter carriage independently through large handwheels which are located on the headstock.

Extreme rigidity has been built into the cutter head of the machine. It is designed for use with ring type thread milling cutters of either the shell or shank type. Cutter spindle is provided with a No. 12 B&S taper and is drilled to permit the use of a draw rod to securely seat the cutter. Cutter spindle, of hardened and ground alloy steel, runs in hand scraped, hard bronze bearings. Cutter head is arranged with a two-speed gear box and with pick-off gears, which together give a total of 18 cutter speeds. Bearings are of the anti-friction type, with the exception of the main cutter spindle bearings.

Three methods of traversing the cutter head are available. By the use of the hand traverse the cutter head can be accurately positioned longitudinally in relation to the work spindle. When threads registered in relation to the part are generated, this fine hand adjustment is particularly valuable. The power operated traverse moves the cutter toward or away from the work spindle but maintains the relation of the cutter to threads which have already been generated. This is of value when the machine is being set up on a job, or when roughing and finishing cuts are desired. By its use a thread can be generated, the cutter backed away from the thread, the thread gaged and the cutter then brought back into engagement with the thread for a second cut. The third rapid traverse mechanism, available as an extra, employs a motor arranged with a solenoid operated brake and is useful for rapidly traversing the cutter toward or away from the work spindle. These power rapid traverse mechanisms have pushbutton and adjustable stop control.

Machine is arranged with an automatic depth stop. A precision micrometer screw and an accurately graduated dial reading in thousandths of an inch permit depth of cut to be accurately adjusted. Once this proper depth is obtained, a positive mechanical stop is set. Use of this automatic depth stop on subsequent cuts assures duplication.

Although the machine is arranged primarily for chucking work, it can be supplied with a swiveling cutter head and a tailstock for work to be



done on centers. When the machine is so arranged, threading can be done with either ring or disk cutters.

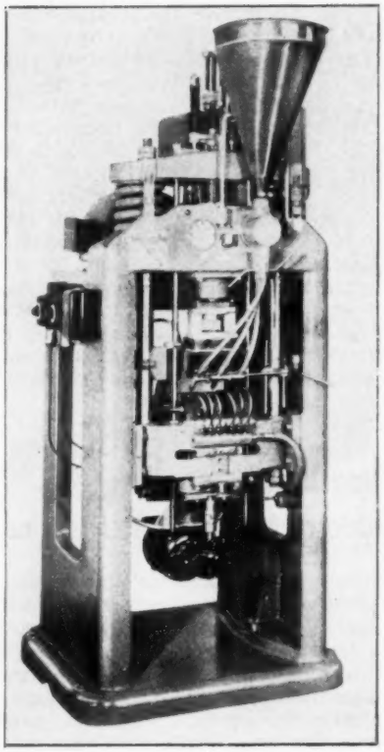
Plastic Molding Machine Forms Threaded Parts

By means of an automatic unscrewing device built into the automatic molding press made by the F. J. Stokes Machine Co., 5930 Tabor Rd., Philadelphia, Pa., threaded plastic parts can be produced in a completely automatic operation at production rates of over 1,000 per mold cavity per day.

Standard machine threads, internal or external, of any desired pitch may be molded, the speed of the unscrewing device being readily adjustable to that of the pitch of the thread. Ejection is positive and takes place at the same time the mold is opening. Thus there is no loss of time or lengthening of the cycle.

By mounting separate molds in the machine and charging each mold individually, one, two and three threaded moldings can be made simultaneously. Single, double or triple powder feed mechanisms are provided to charge each mold with an accurately metered amount of material.

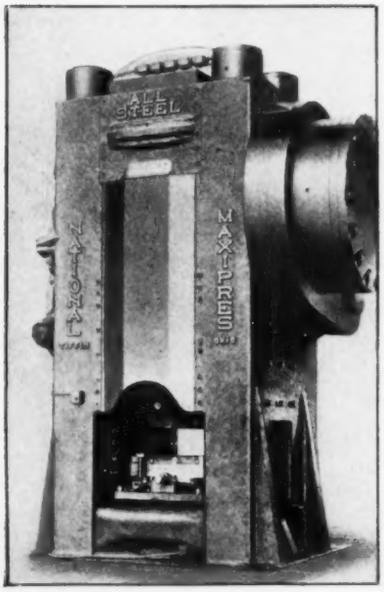
Machine, being completely automatic, requires no operating attention, except to refill the hopper with molding powder and remove finished parts. Since several operations are



performed simultaneously the molding cycle is short. A positive type mold practically eliminates flash and saves molding material and finishing costs. Large output per cavity reduces mold cost per piece.

National High Speed Forging "Maxipres" Developed for Wide Variety of Work

National Machinery Co., Tiffin, Ohio, has developed a new line of high speed forging "Maxipreses" suitable for a great variety of forging work.



With these units, forgings are made in two or three blows which formerly required many additional blows. Better metal flow is said to enable forgings to be made with less flash and less weight of stock than customary, and the extra rigidity is claimed to cause the moving die to come to its extreme bottom position at each stroke so that only one blow is necessary for each die impression. Since impact is reduced, it is feasible to use insert dies, reducing cost and making possible the use of superior quality die steel. With these presses no particular skill is required on the part of the operator.

To obtain high speeds, drive of the presses has been radically changed. The No. 6 model illustrated, which corresponds to a 5,000-lb. steam hammer, or a 6500-lb. board drop hammer, operates at 80 strokes per min. This has been accomplished by transferring the driving clutch from the back gear shaft directly to the crankshaft. Thus there is less dead weight to start and stop, and less power is consumed. An air cylinder working on the upstroke assists in stopping, and provides air for the clutch. This greatly reduces the contact time between dies and the hot stock, and materially improves die life.

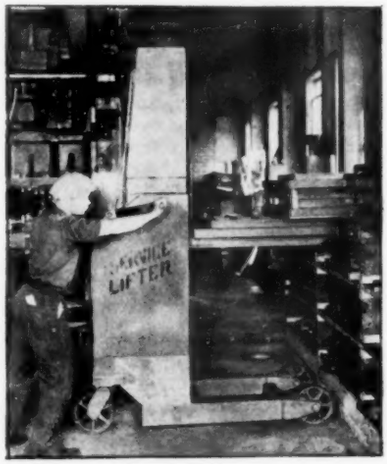
Additional refinements have been incorporated in the construction of these presses to increase their stiffness. One of these is a double wedge construction for supporting the bottom die, which minimizes deflection of the die under the forging pressures encountered.

These "Maxipreses" are built in six sizes from No. 1½ to No. 6, corresponding in capacity to 800, 1,200, 2,000, 3,500, 5,000 and 6,500 lb. board drop hammers. They have operating speeds ranging from 130 strokes per min. on the small size to 80 strokes per min. on the large size. The No. 6 press illustrated weighs 300,000 lb. and has a ram face area of 42x42 in.

Service Portable Die Lifter Performs Three Operations

A portable lifter combining three die-handling operations in one has been made available by Service Caster & Truck Co., 635 N. Brownswood Ave., Albion, Mich. With this unit, dies can be taken from or replaced in the storage shelf, transported from storage to press, and placed in or removed from the press.

When taking dies from storage, the

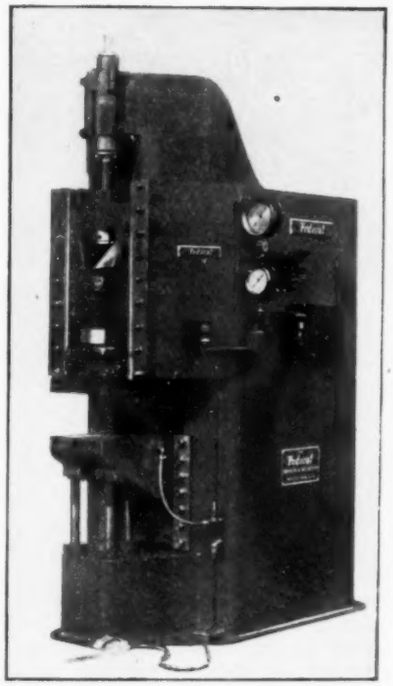


lifter is wheeled up to the rack and the platform elevated to the proper level. A steel cable, running from a winch inside the frame, is pulled out and attached to the die with a nut and bolt. The operator, standing on the floor, turns a crank which pulls the die from the shelf to the lifter's roller platform, and the platform is lowered to a convenient carrying position. After the machine has been wheeled to the press, a few turns of the crank raise the die to the press bed, where it is pushed off to the proper position.

Unit is powered with a hand-operated lifting unit with two lifting

speeds. Lowering is controlled by a heavy-duty flyball governor. Platform is lifted by twin roller chains. Capacity of the machine is 4,000 lb. Overall height is 8 ft.; total lift is 5 ft. 8 in. Lowered height of the platform is 11 in. Platform measures 36 in. from uprights and is 30 in. wide. Base width is 30 in. A worm gear safety hinge permits folding over the top half of the machine to pass through doorways.

Federal Heavy-Duty Projection Welder Features Hydraulic, Air or Motor Operation



A heavy-duty projection welder, which may be furnished for hydraulic, air or motor operation, has been developed by Federal Machine & Welder Co., 212 Dana Ave., Warren, Ohio. Illustrated is the direct hydraulically operated Model P-4 machine.

This model has a two-pressure pump, which gives high-speed operation using a comparatively small motor. Low pressure is used to bring the slide down until the electrodes contact the work. Then the machine is automatically thrown over to high pressure for performing the welding operation. When welding cycle is completed the head is returned by low pressure.

Hydraulic circuit is designed with means for adjusting both high and low pressure so that proper pressure for a given job may be applied. An adjustable pressure switch operates the timer, thus allowing a predetermined pressure to be set. It also insures holding the timing circuit off until the required welding pressure is built up.

This machine is offered in five transformer capacities, ranging from 250 to 600 kva. A four-point regulator switch is mounted on the side of the welder to give eight steps of heat regulation.

Stroke of the welding slide is adjustable from 1 to 4 in., and the lower combination knee and platen has an 8-in. vertical adjustment by means of three jack screws.

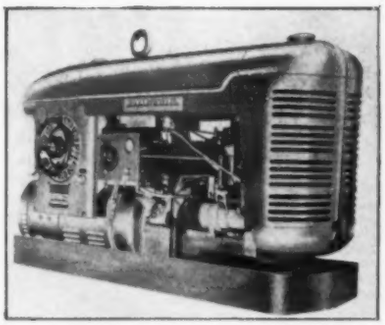
Cooling facilities have been provided in the secondaries, platens and electrodes. Both upper and lower platens are 14 in. square and are fitted with T-slots.

For work requiring a quick follow-up, thus making the heavy slide as used on a machine of this type unsatisfactory, the welding slide may be fitted with a low-inertia head built in the slide and controlled by an air cylinder, which eliminates the weight applied to the electrodes.

Hobart Announces 200-Amp. Gas Engine Driven Welder

Some 1,000 combinations of voltage and welding current are possible from the 200-amp. "Streamliner" Junior gas-engine driven arc welder developed by Hobart Bros. Co., Hobart Square, Troy, Ohio. Powered by a 26-hp. Hercules engine, this welder is particularly suitable for job welding shops, blacksmiths, repair shops, garages and miscellaneous metalworkers.

Oversized design, ample copper and steel, and sensible operating speeds are all said to contribute materially to lower welding costs. Known as

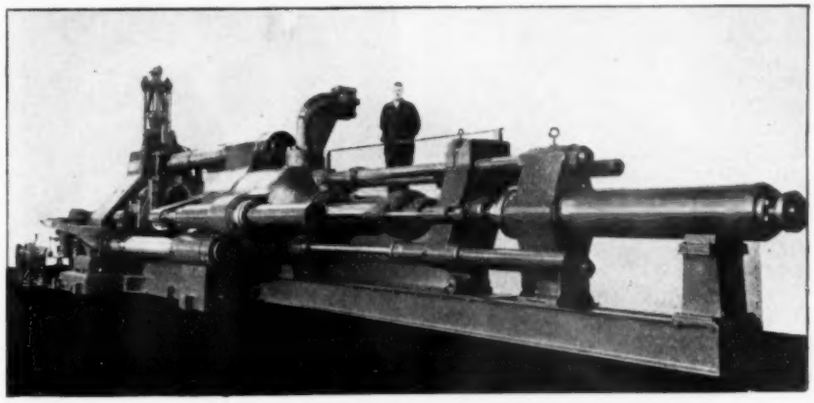


the Model GR-202-S, this unit embodies a modern battery ignition system, electric self starter, electric fuel pumps, self-starting pushbutton and ignition lock. Also included as standard equipment are remote control of welding voltage, polarity switch, convenient power outlet plug, variable-speed governor, solid-core radiator and built-in fuel tank. All are mounted on a rigid steel base, with a sturdy lifting eye for handling with crane or hoist.

Control is by means of "Multi Range" dual control with 10 ranges of welding current and 100 steps of volt-ampere adjustment in each range. Thus 1,000 combinations of open-circuit voltage and welding current are available for any desired arc characteristic. Main range switch is of heavy copper molded in bakelite and controlled by a large hard rubber covered hand wheel. Volt-ampere adjuster is compactly built within the main switch, and is easily removed if remote control is desired. Variable engine speed provides a third method of controlling current values. Excitation is from a special built-in four-pole exciter. Unit is 64 in. long, 21 in. wide and 41½ in. high. Shipping weight is approximately 1,350 lb.

Farrel-Birmingham 2,000-Ton Hydraulic Press Permits Extrusion of Steel and Nickel Alloys

A 2,000-ton hydraulic press built by Farrel-Birmingham Co., Ansonia, Conn., can be successfully employed in the production of stainless steel, nickel alloy and ferrous rods, tubing and shapes, by the extrusion process. It is said that with this machine all the currently known stainless steels



and other special ferrous and nonferrous alloys which do not work well by rolling, welding or piercing can be extruded without difficulty.

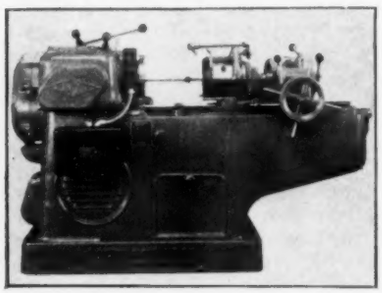
Billets to be extruded by this press can be taken as rough cast billets coming from the foundry after being cut to the proper length. Billet skin, which is formed mostly by oxidation, remains as a thin shell in the container after extrusion, so the extruded product is formed of clean material only. Tubes and rods manufactured by this press are not only remarkably sound in structure, but possess excellent metallurgical and physical properties and a good surface condition. Consequently the number of draws for finishing can be considerably reduced.

The amount of scrap—consisting of the thin shell of the billet and the discard—is very low, so the difference in weight of the billets charged into the container and of the extruded product is only about 8 per cent to 10 per cent in the case of tubes, and about 10 per cent to 12 per cent when manufacturing rods. Concentricity of the extruded tubes is well within the commercial limits, and provided that sound billets, uniformly heated, are used, is within plus or minus 5 per cent of wall thickness.

"Landmaco" Special Threading Machine Built for Extremely Accurate Work

Landis Machine Co., Waynesboro, Pa., has developed an unusually flexible type of the "Landmaco" threading machine, which is designed for handling special threading operations in which extremely close tolerances for concentricity must be maintained between the thread and the body of the work. Since such work is usually ground between centers, provision is made on this machine for supporting the work in a like manner.

Special features of this tool include a faceplate on the machine spindle



supplanting the usual die head, a special carriage front on which the die head is mounted, and a tailstock which is adjustable and which also supports the center. The faceplate, which also incorporates a live center, is employed in the same manner as the faceplate on a grinding machine or lathe, to drive the work with a dog. The special carriage supports the "Lanco" die head which is used as a stationary type head. Provision is made for opening and closing the die head with a yoke when necessary. The adjustable tailstock is clamped into position on ways located on the side of the machine bed. These ways are long enough to permit handling work ranging from 2 to 16 in. long.

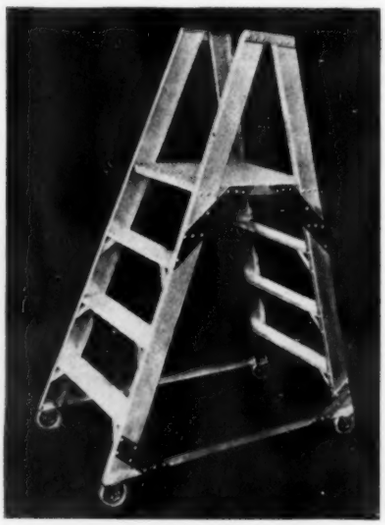
Tailstock center is advanced to or withdrawn from the work by a quick-acting lever located on top of the tailstock. Center can be clamped rigidly by means of a clamping lever also located on top of the tailstock.

This special threading machine is of the lead-screw type. Thus the thread is generated by revolving the work between centers, the die head being propelled onto the work and the thread lead being controlled by means of the leadscrew. Since the work is turned, threaded, and later ground between centers, an unusually high degree of concentricity can be maintained between the thread and the body of the work.

Double Aluminum Ladders Accommodate Two Persons

Two double or A type aluminum ladders, constructed with steps on both sides so that two persons may use the ladder at the same time, have been developed by Aluminum Ladder Co., 104 Adams St., Tarentum, Pa.

Both ladders are constructed of a special aluminum alloy having a tensile strength of 48,000 lb. per sq.in. The No. 900 is 36 in. high, has a platform measuring 12x15 in., and weighs only 13 lb. The feet are fitted with rubber pads. The No. 901, constructed of treadplate for protection against slipping, is 48 in. above the floor and has a platform measuring 19½x22 in. Side rails rise 21 in. above the platform. The ladder



measures 25x41 in. at the base, and weighs only 41 lb. complete. Illustration shows ladder fitted with 3-in. rubber casters, but any type of casters can be supplied.

Watchman's Tour System Calls Help in Emergency

Dudley Lock Corp., 325 North Wells St., Chicago, Ill., has developed a watchman's tour system which can flash or permanently record the time

of inspection and summon aid in emergencies. Said to be adaptable to every size and type of industry, it provides complete mechanical control over the watchman's activities and compels inspection of specific parts of a property at prescribed time intervals.

The system includes a number of key stations with transmitting stations at the start and finish of each series. Transmitting stations can actuate any kind of signal or recording apparatus. A special recording clock developed by Cincinnati Time Recorder Co. records date and time each transmission station is visited. An additional feature is the delayed alarm, which gives a warning at any specified location when a transmitter box is not visited within a given period.

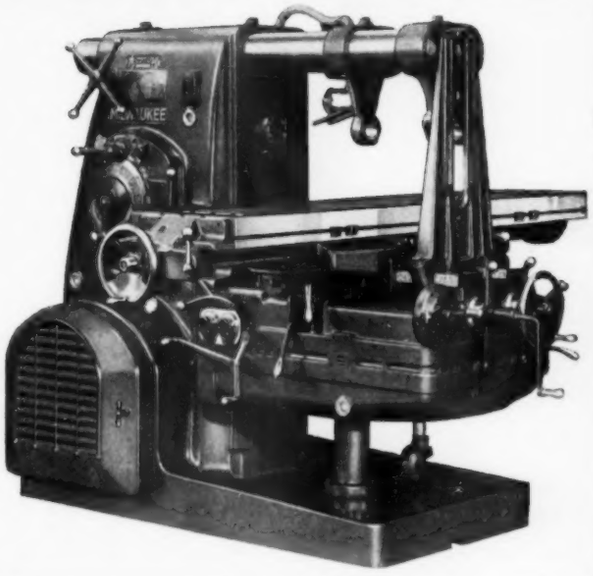
The watchman's key is small enough to be carried inconspicuously. It consists of a combination of three separate locks, operating only on a predetermined route, and only in the proper sequence. It has a built-in cyclometer that counts the stations visited and thus gives proof of completion of specified tours.

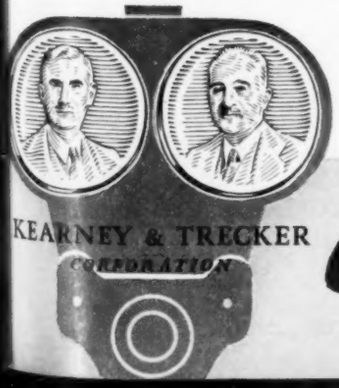
10,000-lb. Portable Pump Supplies "Porto-Power" Rams

A portable, motor-driven hydraulic pump for supplying 10,000 lb. per sq.in. hydraulic pressure to the 4, 7, 10, 20 and 50-ton "Porto-Power" hydraulic rams, has been developed by

A LARGE staff of highly trained technical men — constantly checking, testing, and gauging at every stage of construction and assembly — make sure that every part — every unit — measures up to Milwaukee standards of milling machine quality and accuracy.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WISCONSIN





Milwaukee MILLING MACHINES

Blackhawk Mfg. Co., 5025 W. Rogers St., Milwaukee, Wis.

Known as the Model P-95 "Porto-Power" pump, this unit weighs only 32 lb. and is powered with a built-in ½-hp. motor. It can be connected with high-pressure hose to any one

of the Blackhawk rams, which are otherwise used with hand-operated pumps. Pump can also be equipped with a gage for testing or weighing in tons total load or pounds per square inch pressure.

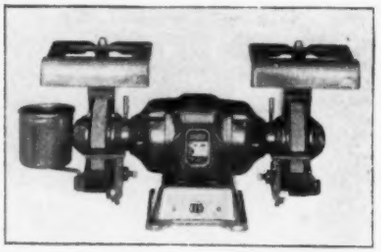
Cellulose Sweat Bands Have Cork Inner Linings

Two ruggedly constructed sweat bands, made of fine-pore cellulose sponge securely stitched to a fabricoid band with an inner lining of cork, have been announced by Jackson Electrode Holder Co., 6553 Woodward Ave., Detroit, Mich. The No. 15, illustrated, is a general purpose band for eliminating the hazard of perspiration running into the eyes.

It is easily adjusted to the head with a long lasting ½-in. elastic band. The No. 5 band is intended for use with all Jackson eyeshields except the Types D, D-6 and No. 25. It is snapped inside the shields. Both bands are light, cool and comfortable, and easily absorb more than fifteen times their own weight in moisture. They are quickly cleaned by letting water or any safe antiseptic solution run through the sponge.

Baldor Deluxe Grinder Has Light in Eyeshield

The outstanding feature of the deluxe grinder offered by Baldor Electric Co., 4351 Duncan Ave., St. Louis, Mo., is the shatter-proof glass eyeshields which accommodate a tubular light, which throws light on either side of and in front of the wheel without creating annoying shadows. Identified is the No. 724 grinder, this 7-in. model is powered with a ½-hp., 3400-r.p.m. motor, and is equipped with 7x1-in. "Aloxide" wheels.

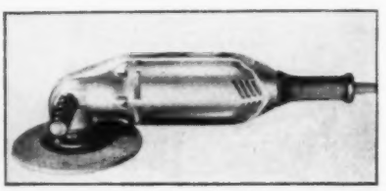


Other features of this machine include spark breakers, a water pot attached to the grinder, and a tool rest which is adjustable to and from the wheel, up and down, and which may be tilted for angle grinding.

Three More Disk Sanders Made Available by Skilsaw

Skilsaw, Inc., 5033 Elston Ave., Chicago, Ill., has developed three additions to its line of disk sanders.

Model SP is a two-speed heavy duty sander and polisher especially developed for steady use in metal fabricating plants where there is a variety of sanding, polishing and buffing operations. When operating at 4,200 r.p.m. with a 6-in. disk, is provides a maximum of sanding efficiency. When changed to 1,300 r.p.m., the tool is suitable for use with felt rubbing pads or lamb's wool polishing bonnets for rubbing down lacquered surfaces and for other polishing operations. A simple gear shift makes it easy to change from one speed to the other. Eight heavy duty ball bearings mounted on all shafts make possible carrying maximum loads and insure quiet operation and long life.



Model SP is 18½ in. long and weighs 14¾ lb.

Model H2, illustrated, is a two-speed heavy duty sander for use wherever sanding work is constant in nature. A 9-in. disk is first used at a speed of 2,700 r.p.m., then, when the outer edge of the disk becomes worn, it is re-sized to 7 in., using a special trimmer provided. It is then mounted on the alternate 7-in. pad and is used at 4,200 r.p.m. Eight heavy duty ball bearings mounted on all shafts give this tool greater efficiency and longer life. Model H2 is 19½ in. long and weighs 16 lb.

Model SL is an extra heavy power unit that can handle a wide variety of heavy duty sanding, grinding and surfacing operations. It operates at a no-load speed of 5,000 r.p.m., the speed recommended by grinding wheel manufacturers as the most practical for 6-in. wheels to insure fastest production and longest life. Model SL may be used with various sanding pads, grinding wheels, wire cup brushes and other accessories. It is 18 in. long and weighs 15 lb.

Screw Machine Cam Blanks Permit Less Cutting Time

Synthane Corp., Oaks, Pa., has introduced a series of cam blanks for Brown & Sharpe automatic screw machines which are claimed to make possible the production of a complete set of cams for these machines in much less time than formerly required. Only a small wood cutting bandsaw, a disk sander and filer are required.

Synthane cam blanks are furnished in sets of three for sizes 00, 0 and 2 B&S machines. All blanks have center hole bored, pin hole drilled, and radial lines scribed for ease of layout.

These blanks are said to be suitable for all but the heaviest feeds, and to be ideal for short runs because they are easily and quickly cut. They are also claimed to produce excellent results on long runs, with runs of over 4,500,000 pieces having been made.

"Universal" Electric Etcher Features Streamlined Design

Everything safely enclosed and out of the way is the outstanding feature of the No. 13 "Universal" portable electric etcher announced by Ideal Commutator Dresser Co., 1057 Park Ave., Sycamore, Ill. Etcher tool and

NEW IDEAS for NEW DAYS

OSTER
THREADING EQUIPMENT
WILLIAMS

HERE is Another One of OSTER'S "NEW Ideas for NEW Days"

Release your turret lathes and other machines for more important work, by using the "RAPIDUCTION JUNIOR" Threading Machine on your second operation jobs. It's an idea worth thinking about and the "RAPIDUCTION JUNIOR" with its ability to handle all sorts of special threading work, speedily and accurately, is an economical way to increase the productivity of your high priced equipment. *Be sure to get details from*

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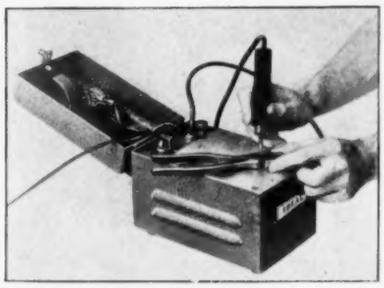
cords, switch and indicator lamp are all under cover. Small objects are etched on the work plate which forms part of the case, while a ground clamp is furnished for larger objects. The cover is removable if desired.

Etching heats are 120, 240, 420 and



700 watts. A red indicator lamp burns brighter as the higher heats are turned on. Plenty of power is provided for permanently marking tools, parts, dies, bearings, saws, drills and other metal objects. Writing is as easy as with a pencil, leaving the mark clearly and permanently burned into the metal. The standard unit is 110 volts, 60 cycles, a.c. power. Over-all size is 7¼x5⅛x 8½ in. Weight complete is 16 lb.

Infra-Red Baking Units Offered in Portable Models

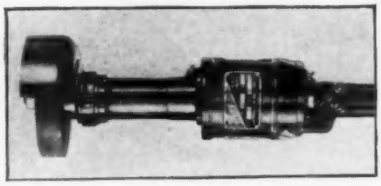
Fostoria Pressed Steel Corp., Fostoria, Ohio, brings the advantages of infra-red baking and drying to small lot work with the introduction of the Model P-7-IR portable fixture. Equipped with seven pure gold plated reflectors, this unit is universally adjustable to permit its use in many types of applications.

This flexible infra-red bank has been especially designed for use on paint and enamel repair jobs. It handles areas up to approximately

30 in. in diameter and can be adjusted to any position desired, and to a height of from 18 to 72 in. The ruggedly constructed portable stand is mounted on easy-rolling casters.

"Thor" Portable Air Grinder Features Positive Starting

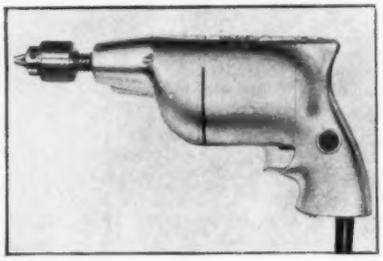
Based on a new "air behind the blades" principle, the No. 255 "Thor" portable air grinder offered by Independent Pneumatic Tool Co., 610 W. Jackson Blvd., Chicago, Ill., assures positive starting under all operating



conditions. Air behind the blades keeps rotor blades out against the cylinder wall, preventing any dead center position or the depression of the blades in the slots due to oil accumulation.

Black & Decker "Tapgun" Weighs Only 3 3-4 Lb.

Black & Decker Mfg. Co., Towson, Md., has introduced a new tapper



to its line of one-hand, high-speed production tools. Known as the "Tapgun," this unit weighs only 3¾ lb. and measures 9¼ in. over-all. It taps up to 5/16 in. in cast iron, 3/16 in. in steel, and ⅜ in. in brass or aluminum. Machine taps at 400 r.p.m., and backs out at 525 r.p.m.

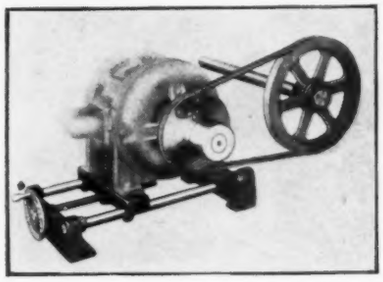
"Vari-Speed Jr." Transmission Designed for Small Mechanisms

Reeves Pulley Co., Columbus, Ind., has developed a variable speed transmission which brings the advantages of variable speed control to even the smallest and lightest machinery. Known as the "Vari-Speed Jr.," this unit can be used with any constant-speed motor up to 1½ hp. Speed is completely adjustable, and no special shaft extension is required.

Unit comprises a disk assembly and adjustable motor base. Disk assembly consists of two cone-shaped disks, one stationary and one laterally adjustable, a self-adjusting tension spring, and a spring adjusting nut and cover. This assembly is applied directly to the standard shaft extension of the motor, which is mounted on an adjustable base. A standard V-belt is used.

An adjusting handwheel moves the motor forward and back. When nearest to the driven sheave, the V-belt runs over the largest diameter on the disks and maximum speed is secured. Reversing the handwheel moves the motor away from the driven sheave, the belt runs over the smaller diameter, and the speed is reduced.

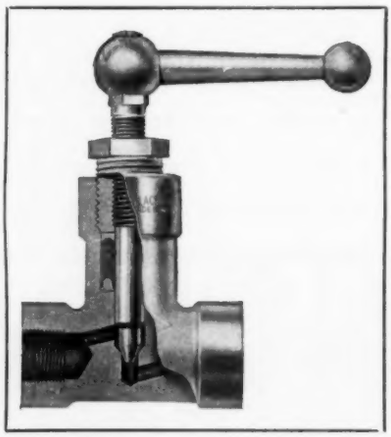
The device is built in six different sizes for use with motors of ⅛ to 1½ hp. Speed control over a range of from 1¾:1 to 2¾:1 is provided, de-



pending on the size, power and speed of the unit selected. Two sizes of motor base are available. The unit is also built in a countershaft type for unusual speed reduction or speed increase.

Blackhawk Needle Valve Stands 10,000 lb. Pressure

A special high-pressure needle valve, made necessary by the growing list of applications for hydraulic equipment, has been produced by the Blackhawk Mfg. Co., 5025 W. Rogers St., Milwaukee, Wis., to withstand pressures up to 10,000 lb. per sq.in. This valve, known as the "V-8," is readily applicable to hydraulic controls of machine tools and other types of equipment. It can be used



with any fluid not injurious to leather, bronze or stainless steel.

In addition to its high-pressure capacity, the new valve is compact and reasonably priced. It is made with standard ⅜-in. pipe taps.

NEW MATERIALS

"Bermax" Bearing Metal Has Many Applications

Continuous research and development since 1930, when lead-base babbitts were considered unfit for use in internal combustion engine main and connecting rod bearings, has resulted in "Bermax" alloy, offered by Federal Mogul Corp., Shoemaker & Lillibridge Sts., Detroit, Mich. Said to offer unusual properties and advantages, this alloy is exceptionally well suited to a wide range of applications in the automotive and other industries. It is claimed to offer substantial savings in a majority of applications for which it is suited, to produce greater efficiency in many applications, to overcome the corrosion problem encountered in many uses, and to be easy to use, easy to cast, and easy to handle in rebabbitting.

"Bermax" is so positioned in the lead-tin-antimony ternary system that an excellent compromise of desirable properties is effected. Its melting point is slightly higher than that of the tin-base metals, and it can be cast by any method without fear of segregation. It is not brittle, and it is not subject to oil corrosion.

TRADE PUBLICATIONS

AERO-THREAD SCREWS Bulletin No. T-1, circulated by Aircraft Screw Products Co., Inc., 25-12 41st Ave., Long Island City, N. Y., offers information on Aero-Thread screws which are used where maximum strength is required.

ASTM STANDARDS American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., offers a 152-page index to ASTM Standards.

BEARINGS A 4-page folder No. A-40 circulated by Chrysler Corp., Detroit, Mich., offers a listing of sizes and prices of Oilite bearings.

BEARINGS Catalog No. 35X issued by the Fafnir Bearing Co., New Britain, Conn., gives full data on dimensions, load ratings, types and sizes of Fafnir bearings.

BERYLLIUM ALLOYS Engineering Data Sheet No. 25, circulated by Beryllium Corp. of Pennsylvania, Reading, Pa., comments on physical properties, heat-treating data and other information of Berylco, a beryllium copper alloy.

CAM GRINDERS Ohio Units Manufacturers, Dayton, Ohio, illustrate the construction and operation of cam grinding equipment in a new 12-page booklet.

DIE CASTING The New Jersey Zinc Co., 160 Front St., New York, N. Y., has issued a 37-page booklet which gives information on designing for zinc alloy die casting.

DIESELS Chicago Pneumatic Tool Co., Chicago Pneumatic Bldg., Chicago, Ill., is circulating bulletin No. 768 which describes the reliability and economy of operation of diesel engines.

ENGINEERING FOUNDATION A 76-page booklet circulated by the Engineering Foundation, 29 W. 39th St., New York, N. Y. recounts its 25 years of service.

FORGINGS An 8-page folder circulated by Drop Forging Association, 605 Hanna Bldg., Cleveland, Ohio, illustrates and discusses the advantages of drop forgings.

GRINDING Printed in six colors, Bulletin No. G-455 published by Cincinnati Grinders, Inc., Cincinnati, Ohio, illustrates and describes the principal features of the new Cincinnati hydraulic universal grinding machine.

LAMPS A four-page illustrated booklet No. F-8500, offered by Dept. 7-N-24, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., describes rim fluorescent lamps which are designed for general or supplementary lighting in low bay industrial areas.

LEWIS IRON Joseph T. Ryerson & Son, Inc., 16th and Rockwell Sts., Chicago, Ill., has issued a 4-page pamphlet describing the application, physical properties, and sizes available of Lewis engine bolt iron.

METAL THICKNESS A four-page folder circulated by E. I. duPont de Nemours & Co., Inc., Wilmington, Del., discusses a test for determining local thickness of electrodeposited zinc, cadmium, tin and copper.

MOTORS Four-page pamphlet No. GEA-3307, issued by General Electric Co., Schenectady, N. Y., illustrates the construction and operating features of self-starting inductor motors.

SPRAY EQUIPMENT A 22-page catalog No. 77, issued by Eclipse Air Brush Co., Inc., 298 Park Ave., Newark, N. J., illustrates a complete line of spray equipment for both manual and automatic operation.

SAFETY EQUIPMENT Price List No. 4, for Safety Catalog No. 40,

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which describes industrial safety equipment is being circulated by the Boyer-Campbell Co., 6540 Antoine, Detroit, Mich.

WELDING Information Circular No. I.C. 7121, entitled "Minerals Used in Welding," published by Bureau of Mines, United States Department of the Interior, is devoted to a discussion of welding-rod coatings and fluxes employed in the welding of common metals.

NEW BOOKS

MOTION AND TIME STUDY—*Second Edition. By Ralph M. Barnes, professor of industrial engineering and director of personnel, College of Engineering, University of Iowa. 382 pages. Published by John Wiley & Sons, Inc., New York, N. Y. $3.75.*

In this second edition of his well accepted volume, the author has extended its usefulness by enlarging certain features and by adding illustrative material. Case studies have been added to the material on process charts, operation analysis, and visual direction, to show widely diverse applications. Summarized results of research studies conducted in industrial engineering laboratories at the University of Iowa have been incorporated in the text. During the past three years more than a million measurements of hand motions used in factory operations have been made in this laboratory.

Present-day requirements for the attainment of maximum production efficiency with available equipment, with the continued interest in fatigue reduction, naturally has led to a widening of the interest of management in time and motion study methods. Today, as never before, management must determine quickly the most economical method and the amount of work that should be done within a given period of time. This new edition of Mr. Barnes' book on time and motion study methods contains many suggestions that should be of value to production supervisors and industrial engineers in the metal-working as well as other industries.

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THE STORY OF SUPERFINISH — *By Arthur M. Swigert, Jr., director of production research, Chrysler Division, Chrysler Corporation, 672 pages. Published by the Lynn Publishing Co., 5106 Buckingham, Detroit, Mich. $5.*

Probably no new process of metal finishing has aroused so much comment in recent years as the Superfinishing process introduced by the Chrysler Corporation, largely through the efforts of David A. Wallace, president, the Chrysler Division. Its proponents have claimed remarkable results from its use while its detractors see in it only an extension of the familiar honing procedure. Whether the process be called Superfinish or by any other name, it has certainly accomplished two things: the extension of fine finish to parts which formerly were left in a rougher state, and accelerated research into methods and materials for achieving quality surfaces.

Mr. Swigert's volume explains step by step just how the process came into being, what it does, how it is applied and the advantages gained by its use. Wherever possible, the points made are clarified by means of illustrations which appear profusely throughout the volume.

Readers of *American Machinist* have had the opportunity of seeing many articles on Superfinish, including the first to be published on this subject. It is, therefore, probably unnecessary to state that the Superfinish process removes the "amorphous" metal left by other means of tooling, using light working pressures and a multiplicity of motions. An important feature of the process is the use of suitable grades of lubricant in order to halt the cutting action when the parent metal is reached.

Those who may have become confused by the many pros and cons surrounding this method of metal finishing will have in this volume a means for leisurely perusal of just how it is being used and what is claimed for it.

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LESSONS IN ARC WELDING—*Prepared and published by the Lincoln Electric Co., 12818 Coit Road, Cleveland, Ohio. 136 pages. $0.50.*

Based principally on experiences of Arthur Madson, this book forms the basis of instruction in the Lincoln Arc Welding School. It is the object of these lessons to present concisely certain fundamentals of welding which the operator should know in order to successfully and economically use the welding process. The text material is divided into 52 individual lessons, each of which presents the study of an individual welding problem and presents the proper procedure.

While these lessons deal especially with the use of Lincoln welding equipment and Lincoln electrodes, since the book appears to have been prepared especially for use in connection with the Lincoln Arc Welding School, the principles discussed and the procedures given are applicable wherever arc welding is used, no matter what equipment is available. Much data on proper welding procedures is tabulated for ready reference. In the back of the book are given a series of questions dealing with each of the individual lessons previously discussed; answers to these questions also are tabulated in another section.